THE AMERICAN GAS LIGHT JOURNAL

REDMANKENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXX. No. 23. Whole No. 1,513. | NEW YORK, MONDAY, JUNE 6, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

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[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[OFFICIAL NOTICE.]

Twenty-Seventh Annual Meeting, Western Gas Association.

OFFICE OF SECRETARY,
NEW ALBANY, IND., May 19th, 1904.

The Twenty-seventh Annual Meeting of the Western Gas Association will be held at St. Louis, June 14, 1904, and will be called to order at 10 o'clock A.M., by the President, Mr. F. H. Shelton, of Philadelphia.

The sessions of the Association will be held in the Gas Exhibit Department of the Louisiana Purchase Exposition, which is under the direction and control of the Western Gas Association.

On June 15th and 16th will be held the sessions of the Gas Congress of all American Gas Associations, of which the Western Association is a member.

On account of the Western's session being limited to one day, the paper list will be as follows:

"Low Candle Power Gas," by Mr. William Henry White, of New York.

"Coal Projectors," by Mr. F. H. Shelton, of Philadelphia, Pa.

"Wrinkle Department," Edited by Mr. Wm. E. Steinwedell, of Cleveland, O.

The Western Gas Association will contribute the following papers, to be read at the Congress of the Gas Associations of America:

"Gas Inspection," by Mr. Ira C. Copley, Aurora, Ills.

"Station Meters," by Mr. Donald McDonald, Albany, N. Y.

"The Labor Question," by Mr. F. H. Shelton, Philadelphia, Pa.

Railroad Rates.—The railroads composing the various Passenger Associations have granted rates to St. Louis during the Exposition cheaper than those granted on the certificate plan. There are several classes of rates, as follows:

Central Passenger Association, covering the territory bounded on the North (with the exception of the State of Michigan) by the Great Lakes between Chicago and Buffalo; on the East by Pittsburg and Buffalo; on the South by the Ohio river; on the West by Chicago, the Illinois and Mississippi rivers.

Season tickets, good from April 15th to December 15th, 1904, at 80 per cent. of usual rates; 60-day tickets, 80 per cent. of usual rates, where single way tickets amount to less than $3.75. One and one-third fare for round trip where the usual one way rate is more than $3.75.

One and one-fifth rate tickets, good for 10 days for round trips from points from which one fare is $8 or more. The remaining Passenger Associations, comprising nearly all the territory outside of the Western Passenger Association, announce rates as follows: Season tickets 80 per cent. of double one-way rate; 60-day excursion tickets, 1½ fare for round trip; 15-day excursion, rate one fare plus $2 for round trip ticket.

The Southeastern Association, however, where the distance is more than 350 miles from St. Louis, charges one fare plus $2.25 for round-trip ticket.

A consultation with the passenger agents in the various localities will secure rates to St. Louis, with the privilege and restrictions imposed by the different rates obtainable.

The Hotel Jefferson will be the Association's headquarters, and Mr. E. G. Cowdery, Chairman of the Committee of Arrangements, announces that "The Committee will be represented at all times, in this location, by efficient help to be of assistance to delegates in any way they can."

The Committee of Arrangements announce rates at the various Hotels as follows:

Hotel Jefferson: $7 to $12 per day for room; privilege given for two persons to occupy a room.

Planters' Hotel: $3 per day per person; European plan. The hotel will place four persons to a room.

St. Nicholas Hotel: $7 per day and upward per room; European plan. Two persons privileged to occupy a room.

St. James Hotel: $7 per day per room, with privilege of two to four persons to each room.

The "Inside Inn," located upon the Fair Grounds, offers the following rates:

European Plan Includes Lodging and Daily Admissions.	Number of Rooms.	American Plan Includes Lodging and Daily Admissions.
$1.50 a day.....	500	.....$3.00 a day.
2.00 "	500	..... 3.50 "
2.50 "	500	..... 4.00 "
3.50 to 5.50 a day....	500 with bath	....$5.00 to 7.00 "

Single meals: Breakfast, 50 cents; luncheon, 50 cents; evening dinner, 75 cents. *A la carte* service at moderate prices.

Persons desiring to join the Association will have application blanks mailed to them upon application to the Secretary.

JAMES W. DUNBAR, Sec'y.

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[NOTICE.]

Congress of American Gas Associations.

SECRETARY'S OFFICE,
58 WILLIAM ST , N. Y. CITY,
May 4, 1904.

The following Associations have agreed to participate in the Congress of American Gas Associations, to be held in St. Louis, June 15th and 16th: American Gas Light Association, New England Association of Gas Engineers, Western Gas Association, Pacific Coast Gas Association, Ohio Gas Light Association, Southwestern Gas, Electric and Railway Association, Michigan Gas Association, Wisconsin Gas Association, Kansas Gas, Water and Electric Light Association, Society of Gas Lighting, Guild of Gas Managers. The concurrence of all these Associations insures a successful Congress.

The following papers have been definitely promised:

"The Labor Question," by F. H. Shelton, Philadelphia, Pa.
"Gas Association Work," by Henry L. Doherty, New York city.
"Station Meters," by Donald McDonald, Albany, N. Y.
"Gas Inspection," by Ira C. Copley, Aurora, Ills.

It is intended to secure also either a paper, or a series of short papers, on the subject of "Inclined Retorts versus Horizontal Retorts Operated by Machinery."

Announcement as to Entertainment.—The sub-Committee on Arrangements for the Congress of American Gas Associations has planned to have, for the entertainment of the members of the Congress, a special entertainment on the "Pike," the evening of Wednesday, June 15th, and a banquet at the Hotel Jefferson the evening of June 16th. For the benefit of those who are not "posted," it may be explained that the "Pike" corresponds to the "Midway" at the Columbian Exposition in Chicago in 1893. The ladies will be given, on the afternoon of Thursday, a lunch and a ride round the Exposition grounds. Coupon tickets, each of which will entitle the holder to take part in the entertainment provided for members, and also entitle two ladies of his own family to take part in the entertainment provided for the ladies, will be sold to members of the Congress at the price of $5 per ticket. Extra tickets will have to be procured for ladies not included under above provision.

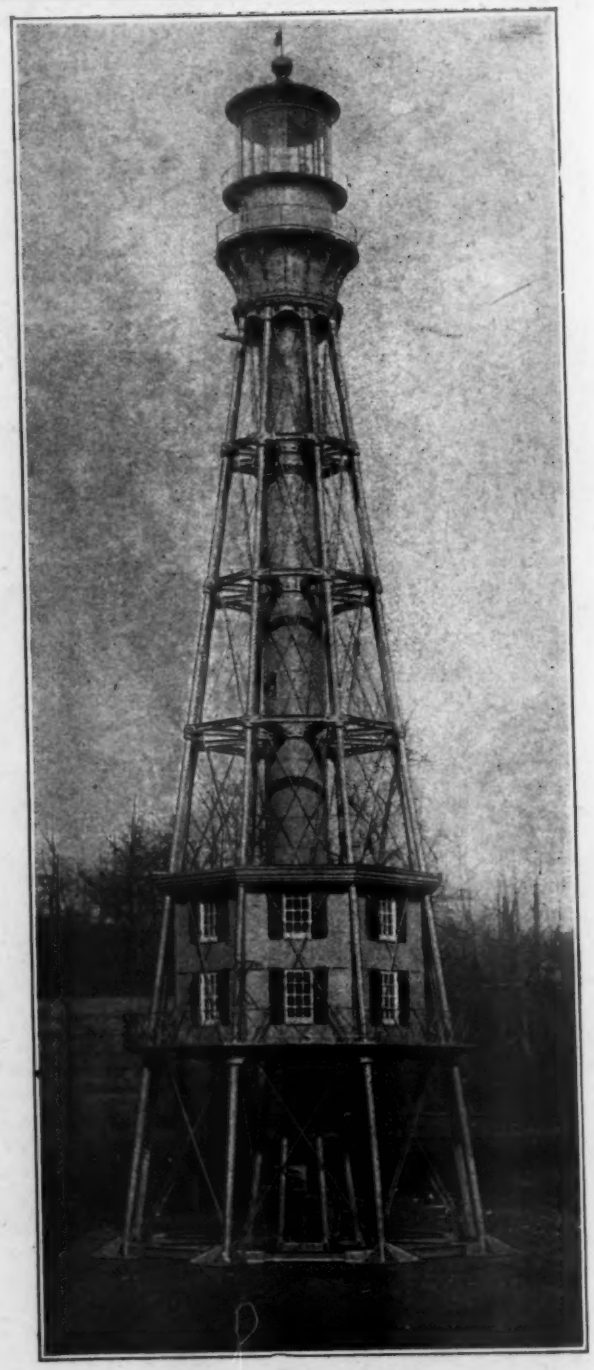
As the Committee must know at an early date how many are to be provided for, you will greatly facilitate its work by mailing to the Secretary at once the inclosed postal card, after filling it out, so as to show whether or not you expect to attend the Congress, and, if you are going to attend, the number of tickets that you wish to take. The sub-Committee is also having prepared special badges, which can be obtained by members of the Congress, that will undoubtedly be valued by them as souvenirs of the occasion.

A. E. FORSTALL, Sec'y.

BRIEFLY TOLD.

THE WESTERN'S MEETING AND THE CONGRESS OF AMERICAN GAS ASSOCIATIONS.—He would indeed be the veriest doubter who, having listened to the testimony put out in the JOURNAL office during the last 10 days by representative gas men, respecting the part that the gas industry is taking and going to take in the St. Louis World's Fair, could reach any other conclusion than that it has been and will be a thorough success. All the preliminaries regarding the twenty-seventh meeting of the Western Association are completed, and the finishing touches are being put to the details of the Gas Congress, and when both sessions are completed a bright mark on the gas history of the world will have been made. Respecting the actual progress of the Fair proper, it can be safely said that its vast and varied features are set and in good working order, and it is our pleasant province to add that the exhibit of the Western Gas Association was not only one of the first to be placed, but that it also has been managed with zeal and discretion that continued from the start. The separate "shows" elsewhere of firms connected with gas trading have also been kept right to the front. In fact, the gas representation in general is one of which the gas makers and sellers and the manufacturers of gas apparatus as well may view with satisfaction and pride. From positive knowledge respecting the attendance at the Meeting and the Congress, we say that at least 175 delegates will be on hand to participate therein from points east of New York.

The local committees can positively be counted on to attend to it that no gas man or his people will be neglected in respect of accommodations, hotel or otherwise. The committeemen's task is a hard one, but as they are familiar now with the situation, the methods born of knowledge it may be taken for granted will be readily applied by them. To hark back to the attendance, we can say that as it is in the East, so also is it in the Middle States, the West, the South and the far West, on this point. We had hoped to receive in time for this issue a plate of sufficient dimension to fairly show the scope of the Western's exhibit, but failing its receipt we herewith print the first photograph taken. The other illustration, of course, is a picture of the "Exhibit's" crowning glory—a reproduction of the Government lighthouse at Southwest Pass, Louisiana, famous in history and renowned for the good work it has accomplished for the sailormen.



The Bristol Thermometer-Thermostat.

The Bristol Company, of Waterbury, Conn., is placing a new instrument upon the market to which has been given the compound name as above, since it is a combination thermometer and thermostat. There is a demand for an instrument of this character which will give correct indications of the temperature of the atmosphere, gases or liquids at all times, and also serve as a thermostat to make electric connection at any predetermined limits of temperature for the purpose of operating controlling apparatus, alarms and the like.

Fig. 1.

Fig. 2.

Fig. 1 shows an external view of the instrument, which is provided with a 6-inch scale, graduated in degrees F.

The construction and capabilities of this instrument will be best underderstood by referring to the interior view, shown in Fig. 2, in which *A* is an arm pivoted at lower portion of the case, terminating in a point resting on the arc of the graduated scale, and is held by friction at whatever point it may happen to be set. Two adjustable contact pieces, *B* and *C*, are carried by this arm. These contact pieces are capable of adjustment by means of a screw *D*, which is threaded so as to cause the contact pieces *B* and *C* to approach or recede at equal rates and distance from the center line of the arm *A*, upon which they are supported. They are also connected to binding posts as shown, which are used for making outside connections. These binding posts are located within the case, to avoid any possibility of the wires or connections being disturbed without detection. Three holes with insulating eyelets are provided in the lower portion of case, as shown, for the insertion of connecting wires. The high and low contacts can be placed on a single or on independent circuits. The arm *E*, moving over the graduated scale, indicates the changes of temperature where the instrument is located. This arm is operated by one of Bristol's recording thermometer tubes placed in the perforated protecting projection extending from the back of the case, as shown in the illustration. On the back of the indicating pointer, *E*, there is a raised portion which makes electric connection with the contact pieces.

A novel feature of the instrument is that the temperature, indicating arm *E* is not restrained by the thermometer-thermostatic contacts, Thus it will be seen that the controlling effect of the thermostat is perfectly adjustable as to position on the scale of the thermometer, and also as to high and low limits of operation, without in any way interfering with the correct indications of the thermometer, in case the temperature does not remain, or is not controlled within the limits for which contact pieces may be set.

The instrument may be readily applied to liquids; as, for instance, to indicate the temperature, and set into operation controlling apparatus for the brine in a refrigerating system or tank.

For a temperature above the atmosphere, such as occurs in ovens, kilns, closed spaces, or of liquids in pipes under pressure, a small bulb is located within the closed space or pipe. This bulb is connected with the thermometer-thermostat by a capillary tube filled with alcohol. The temperature at the bulb is communicated to the instrument which may be located at any convenient point for observation.

The electric wires connecting with the adjustable thermostatic contacts may be carried to any point where the controlling apparatus may be located or where it is desired that an alarm shall be given.

From the foregoing description it will be seen that the instrument is very flexible in its application, and it is not improbable that other applications may suggest themselves to the reader which have not been thought of in the preparation of this description.

The Bronder Retort House Machinery.[1]

DRAWING OR CHARGING FOUR RETORTS SIMULTANEOUSLY—A BUCKET HOT COKE CONVEYOR AND STEAM EXHAUSTER.

The novelty for English gas engineers of the retort house machinery inventions of Mr. G. A. Bronder, of New York, is a sufficient reason for publishing additional information and illustration in regard to it; and both we took steps to secure on receiving from Mr. S. Y. Shoubridge, the Engineer of the Crystal Palace District Gas Company's works, the interesting photographs (recently reproduced) that had been forwarded to him portraying the 3-tier charging and drawing machines which are in operation in Toronto. Since then the publications of the Ohio Gas Light Association have made us acquainted with the fact that the charging or drawing of 3 retorts simultaneously is not the goal of Mr. Bronder's ingenuity. He has surpassed that by building machines, which are also in operation, to deal with 4 retorts in one operation. It will thus be seen that what is a novelty for gas engineers in this country is not so now among our American friends; and it may certainly be taken as a sign of satisfaction on their part (or on the part of several of them) with the performance of the machines when we find that the discharging rakes for dealing with 3 or 4 retorts at once are in use at the works of the Consolidated Gas Company in New York, the United Gas Improvement Company in Philadelphia, Mount Vernon, N.Y., Newark, N. J., the Toronto Consumers Gas Company, the Worcester (Mass.) Gas Light Company, the Detroit City Gas Company, and the Montreal Gas Company; while the charging machines are doing service at all of these works, excepting Worcester and Newark. Through the kindness of Mr. Bronder, we are able to give photographs of examples of the 4-rake and 4-scoop machines now at work.

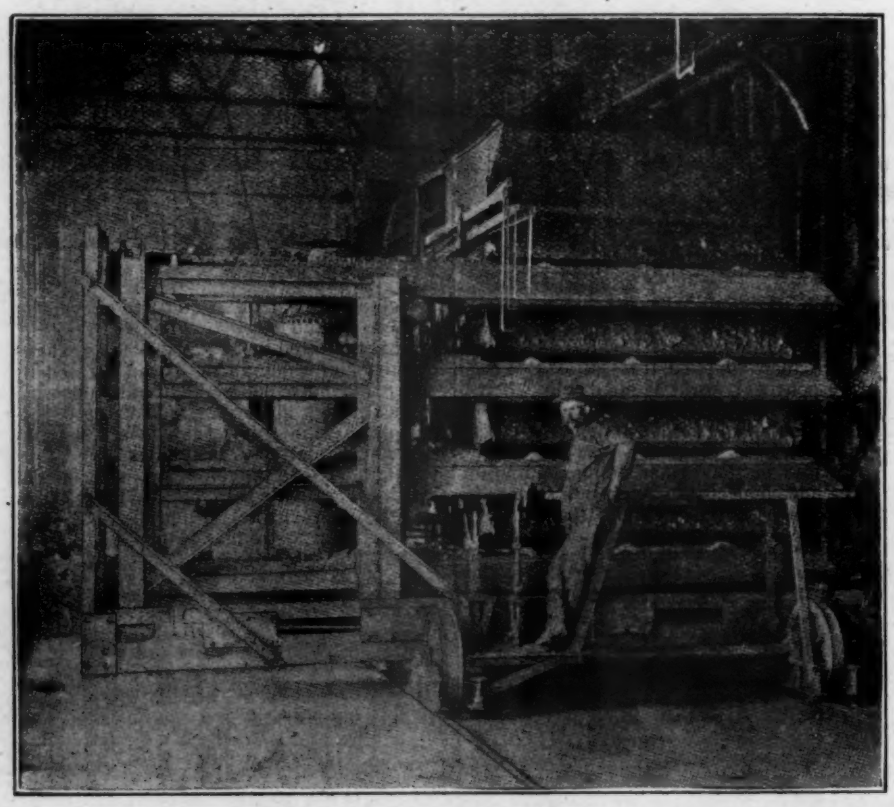
By consulting previous publications, details of the construction of the machines can be gathered; but generally it may be stated, from the particulars now to hand, that the machines can be driven by steam or electricity. Where steam is used, the boiler is fed with hot coke direct from the retorts. The propelling of the machines along the front of the benches is performed by a steam engine. The rakes are operated simultaneously by one man, clearing (as the case may be) 3 or 4 retorts at a time; but, when some of the retorts are being scurfed, one or more rakes can be used indiscriminately as desired. The figures supplied show that a 3-rake machine can draw 42 retorts in from 15 to 20 minutes; a 4-rake one will draw 56 retorts in the same time. This, it is pointed out, is actual work.

Regarding the 3 or 4-scoop charging machines, each scoop is capable of holding from 300 to 460 pounds of coal, according to the size of the retort. The scoops are likewise operated simultaneously by one man, who also fills them by means of pushers worked by small steam engines. The outer end of the scoop (as explained in the previous article) is provided with a flange or horn, which causes the coal, when the scoop is retiring, to spread well against the sides of the retort; and as the layer is automatically deposited in the scoop to be heavy in front, with a gradual lightening towards the back, a layer is obtained (says Mr. Bronder) in accordance with the heat, and so a maximum weight of coal is perfectly carbonized all through. As with the rakes, so with the scoops, 1, 2, 3 or 4 can be used indiscriminately when retorts are being scurfed. The performance of a charging machine with one man is found to be equal to that of a drawing machine—viz., with a 3-scoop machine 42 retorts can be charged in from 15 to 20 minutes; and with a 4-scoop machine, 56 retorts in the same time.

In this connection a cost sheet supplied by Mr. W. H. Pearsou, Jr., the Superintendent of the Toronto Consumers Gas Company, is of interest. It will be remembered that the photographs previously published were of the 3-scoop and rake machines at Toronto. The figures from these works show the cost per 1,000 cubic feet of gas, including, be it remarked, all the men engaged on the coal and coke conveyors, machines, retort lids and furnaces complete. On the 4-tier retort beds, with 4-tier machines, the cost would, of course, be proportionately less. However, Mr. Pearson writes: "We can work 178 mouthpieces, yielding 10,000 cubic feet per mouthpiece per 24 hours, charging about 365 pounds of coal. This would give us 1,780,000 cubic feet per 24 hours. Allowing for retorts being off 'carbonized,' this would slightly reduce the make." The number of men required to operate, as above, is as follows:

2 fire men 6 lid men 2 top men 4 machine men 4 furnace men 2 coke conveyor men 1 coal conveyor man	Total 21 men, making 1,780,000 cubic feet.

1, *Journal of Gas Lighting.*

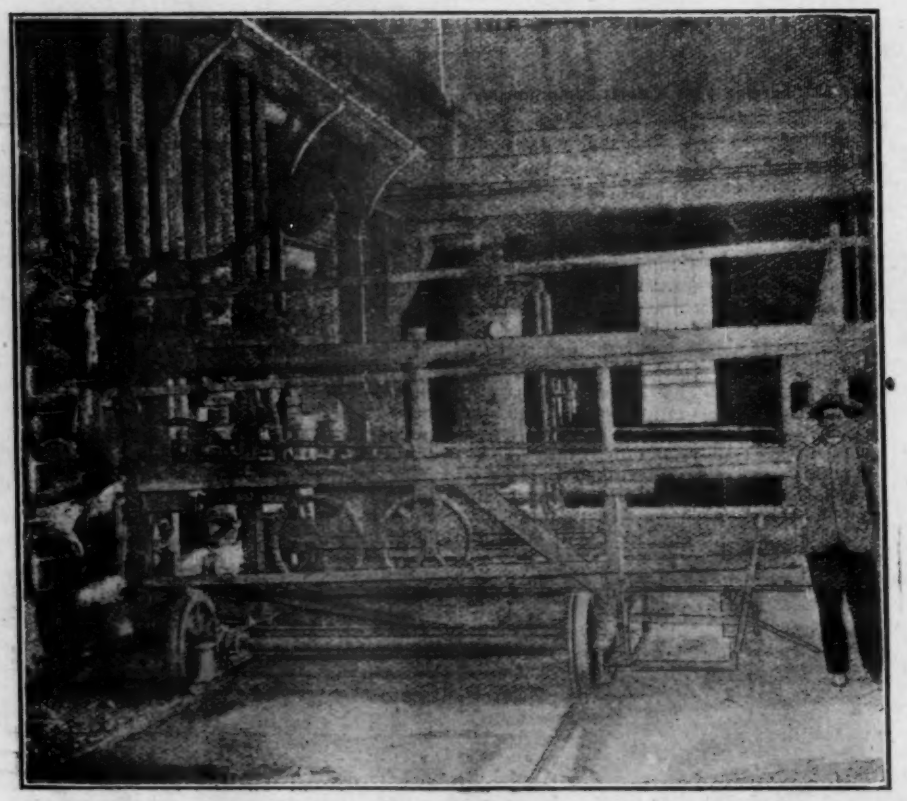


The Bronder Four-Scoop Charging Machine.

1,780,000 cubic feet, divided by 21 men, equal 84,762 cubic feet per man per day; 21 men × $2.25 per day, equal $47.75, which equals 2.68 cents per 1,000 cubic feet." Mr. Pearson adds that he is quite satisfied that these results can be realized continuously with the above number of men.

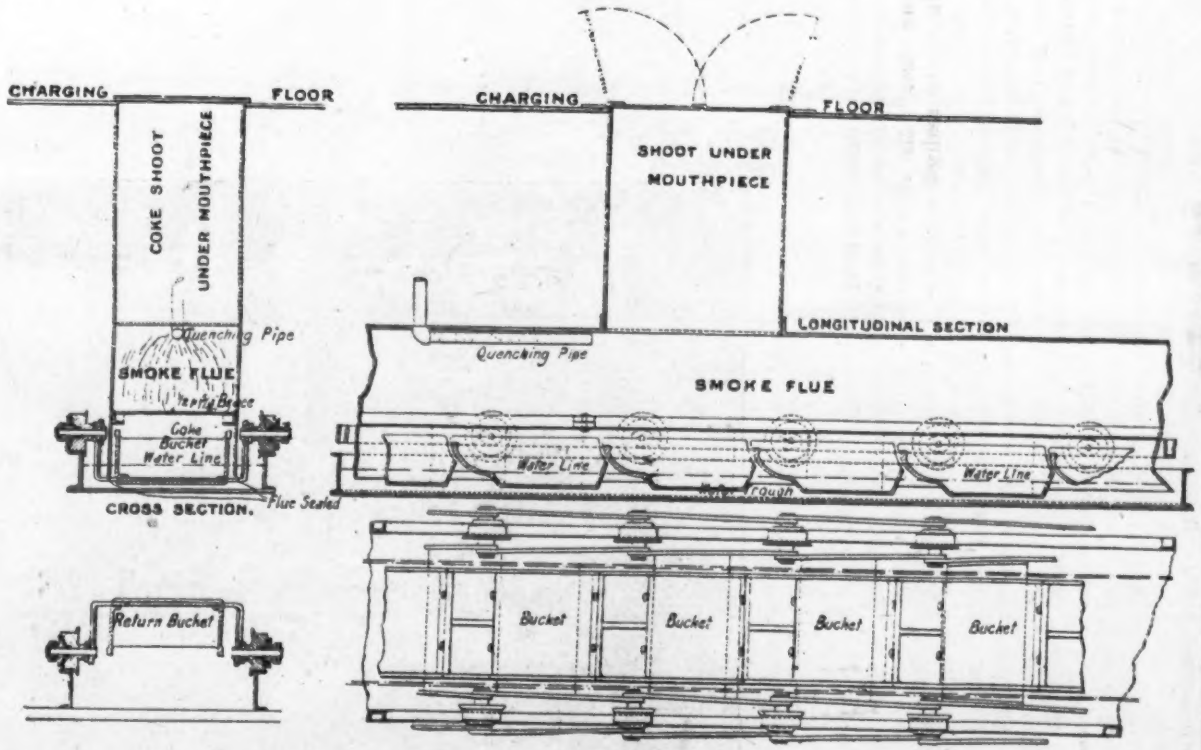
This brings us to another invention, or rather a combination of inventions, by Mr. Bronder; and that is his hot coke bucket conveyor, quencher and steam exhauster. To illustrate this portion of the article, a plan is given of the Toronto coal and coke conveyor, and other drawings show the arrangements of the Bronder conveyor, quencher and steam exhauster.

From the descriptive particulars supplied, it is learned that the water trough in which the conveyor works is filled, through its entire length, with water, which is kept circulating by means of a water wheel. The bucket chain runs in the trough; the sides forming the tracks for the rollers. A flue covers the whole length of the chain; the lower edges of the former dipping into the water to form a seal. The flue connects at each bench with one or more shoots, through which the coke drops into the buckets. When not in use, the buckets are covered. At the ends of the trough and flue, care is taken to prevent considerable leaks of air between the conveyor chain and the sides and top. The flue is also connected by a large pipe to an exhauster, driven by steam, by

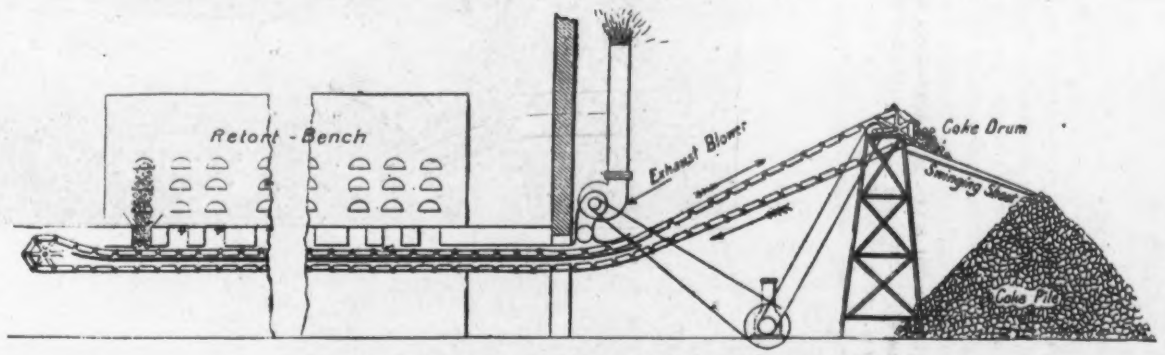


The Bronder Four-Rake Drawing Machine.

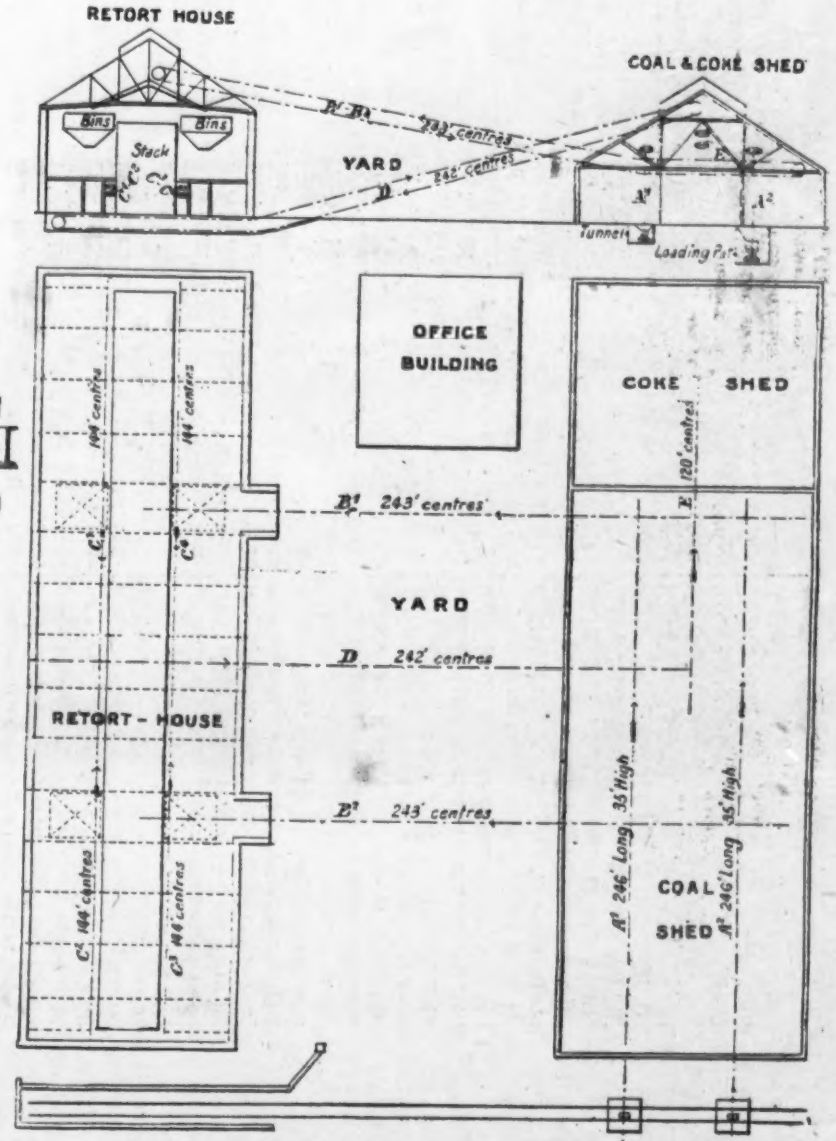
American Gas Light Journal. June 6, 1904.



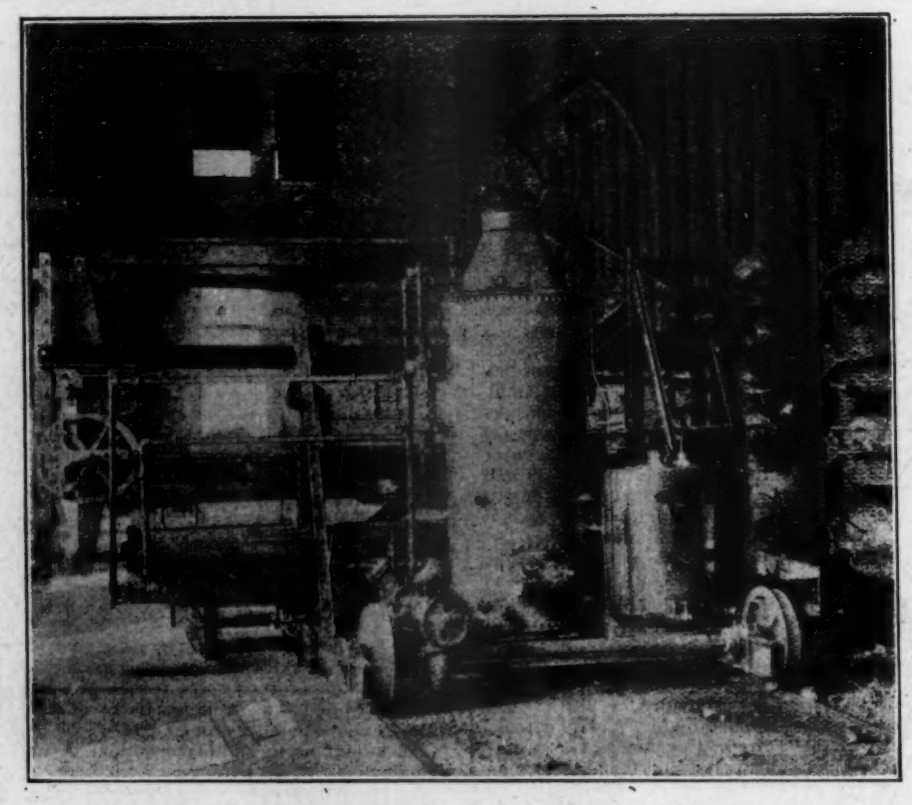
PLAN OF GENERAL ARRANGEMENT OF THE BUCKET HOT-COKE CONVEYOR, QUENCHER, AND STEAM EXHAUSTER.



HOT-COKE CONVEYOR, AND EXHAUST BLOWER FOR STEAM.



PLAN OF THE TORONTO COAL AND COKE CONVEYOR SYSTEM.



View from the Opposite Side of the Bronder Four-Rake Drawing Machine.

means of which all the steam created by the contact of the water and hot coke is exhausted and sent to a chimney, which carries it high above the roof of the retort house. The bucket conveyor chain being carried on rollers running on the outer edges of the trough, and outside the sealed flue, it is evident that not only can the rollers never become hot, but no coke dust can interfere with their pins. They are oiled automatically; each being provided with felt-filled chambers—lubrication being accomplished by contact while passing.

Now referring to the drawings to see the application of the system. The conveyor lines are built about 150 feet centers. At the Toronto works, there are four lines dumping the coke into one cross line *D*, and one longitudinal line *E*, which continues the travel of the coke to the coke shed. The coke is well quenched, and the cellar is free from any steam, which allows of windows being used. The plant has been running at Toronto since September, 1902. Each conveyor line is driven by one of the Bronder 4-cylinder engines, a photograph of which was given on March 29 last. There is a certain amount of wear on the pins of the rollers due to the coke dust; but as they are well protected, continually lubricated, and made for easy replacements, maintenance is brought down to a minimum.

On the general plan will also be seen the system of bucket coal conveyors, coal crushers, and transverse conveyors feeding the bins over the charging machines at Toronto. This system works as follows: A wagon load of coal is dumped into a large hopper above the crusher—taking from about 15 to 18 minutes to be broken, and taken up by one of the two conveyors A^1 A^2. This coal can either be stored in the coal shed (capacity about 12,500 tons), or be directly conveyed by one of the cross lines B^1 B^2 into the retort house, emptying there into large bins (each containing about 80 tons of coal) on each side of the retort stack. These bins feed the charging machines by gravity—the machine hopper being large enough to take 5 or 6 tons of coal; and the machine, without being reloaded, is capable of charging from 24 to 30 retorts. If it is desired to take coal from the coal shed, the coal is caused to descend through shoots and gates feeding the return bucket chains in the tunnels under the coal shed, which chains lift the coal, and deliver it on to the cross conveyors B^1 B^2.

In the coke and coal plants here described, the use of a bucket conveyor for receiving the spent charges from the retorts will have especial interest; the methods by which the buckets are fed and the working parts protected, together with the exhaustion of the steam, forming important features. The exhaustion of the steam arising from the quenching of the hot coke is a practice that has not yet come into vogue in this country; but one home retort house plant contractor we know has designed an arrangement for this purpose.

A New Portable Capillary Electrometer.

By Mr. L. Ramakers.

According to *Electricity*, Mr. S. W. Y. Smith, M.A., Demonstrator in Physics, Royal College of Science, London, recently presented to the Physical Society a new portable capillary electrometer, the principal advantages of which over other types existing are as follows: The liability to get out of order is reduced to a minimum; the liquids being completely inclosed, the instrument can be carried about freely, evaporation of the electrolyte is prevented and adjustments to different degrees of sensitiveness are made very easily. The pneumatic key, free from appreciable thermo-electric effects, and requiring no attention, greatly facilitates the observation of minute electro-motive forces by means of the capillary electrometer; keys of the kind described can be used in measurements in which the electrometer is not employed and form convenient commutators, make-and-break keys, etc. They can be worked at a distance with certainty, and, engaging very little of the observer's attention, allow almost undivided observation of deflections, etc., arising from changes of contact produced by their means.

The instrument presented by Mr. Smith is a modification of the form of capillary electrometer represented in Fig. 1, and consisting of two wide tubes joined across by a capillary tube which is cylindrical, and may be horizontal or may slope upwards at any angle from *b* toward *a*. The apparatus contains mercury and sulphuric acid of about maximum conductivity, distributed roughly as shown.

A spring key, like that represented in the figure, is commonly used with the instrument and keeps the platinum terminals P_1 and P_2 at the same potential unles the lever *S* is depressed. When the lever is depressed the potentials of the terminals become E_1 and E_2, which may, for example, be the potential of two points in a potentiometer circuit. It is the function of the instrument to determine whether these potentials are the same or different.

The nature of the modifications made in the present electrometer is shown in Fig. 2. To prevent evaporation of the sulphuric acid solution, without preventing free motion of the liquids within the apparatus, the wide tubes are closed at the top, but are joined across by another tube opening into them as shown. With this arrangement the apparatus is made airtight, and can, if desired, be made air free by exhaustion of the apparatus before sealing. The apparatus contains approximately enough mercury to completely fill one limb, and about half as much sulphuric acid solution. By suitably adjusting the distribution of the mercury and the solution in the two limbs, the apparatus can be arranged for use with the capillary tube either horizontal or tilted upwards at a considerable angle.

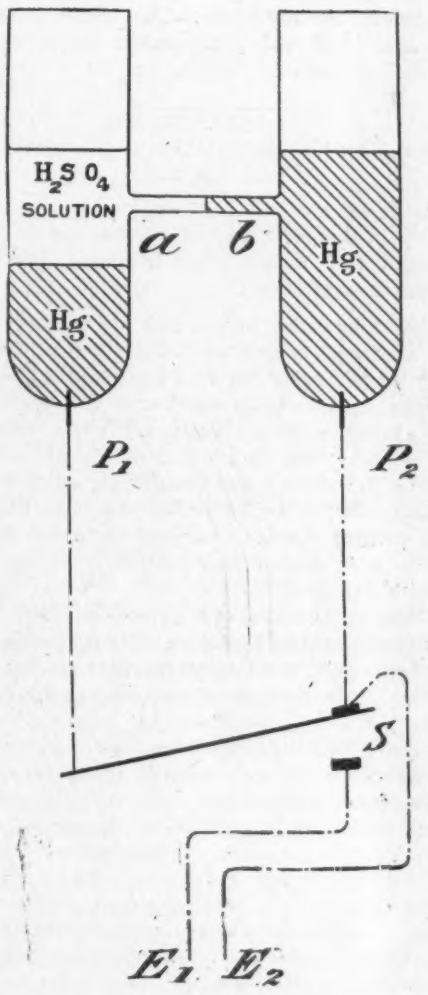


Fig. 1.

The distribution of the mercury can be altered most easily by means of a cross-piece provided with a top as represented in Fig. 2 by dotted lines. When the top is open there is free communication between the mercury in the two limbs, and the relative amount in each can be altered by tilting the apparatus. When the top is closed the two quantities of mercury are insulated from each other.

The usual spring key has several disadvantages. Thus, if it is made of brass, the contacts frequently become unsatisfactory through surface tarnishing, and if, to avoid this, the bearing surfaces are made of platinum, the key sometimes shows pronounced thermoelectric effects. Further (and this is a point of some importance in a portable instrument), the key cannot conveniently be fastened on to the same stand as the rest of the instrument, for, unless the stand and the support on which it rests are very rigid, the pressure necessary to depress the spring produces sufficient movement of the meniscus, by change in the inclination of the capillary tube during the act of depression, to render the detection of minute changes of surface tension possible.

The mercury key, represented in Fig. 2, is free from these disadvantages. It consists, as shown, of a U-tube closed at one end and communicating at the other with a pneumatic pressure ball and containing mercury in the bend. Three platinum wires are fused into the tube and connected as shown. It is obvious that the same change of contacts is produced by squeezing the ball B, as by depressing the lever S in the spring key. The mercury in this key takes the place of the lever in the spring key, and the two different contacts between it and E_1 and E_2 respectively are here quite definite and practically independent of the amount of pressure exerted upon the ball B. Further, the contacts are not exposed directly to the laboratory atmosphere. The thermoelectric effects are very small since the changing contacts take place between platinum and mercury which are almost identical thermoelectrically. The warmth communicated to the key from the hand of the operator can be neglected, and the heat produced by the compression of the air in the key need only be very small. The key can be fixed in the same stand as the rest of the apparatus, for even if the pressure which changes the contacts is applied as suddenly as possible the maximum vertical pressure upon the stand is only a few grams, whereas in the case of the spring key it may be 500 grams or more.

By adjusting the length of the mercury column in the key so that it

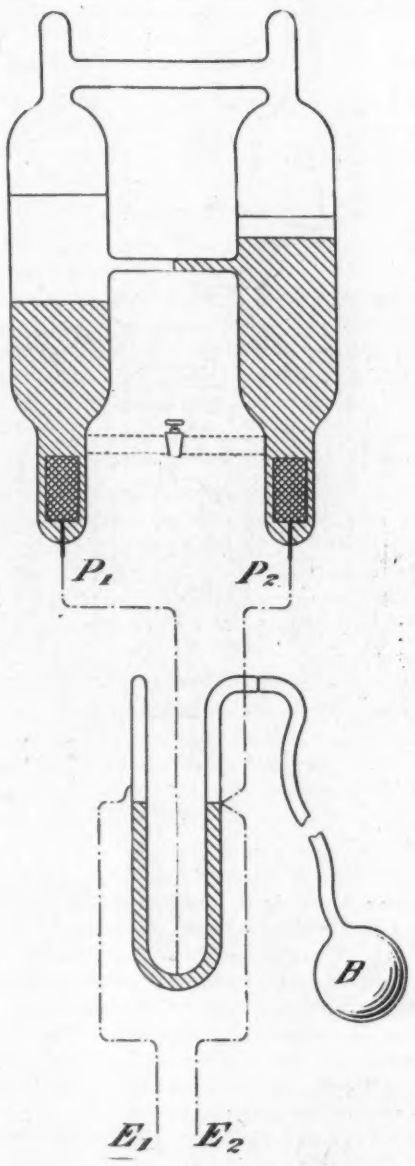


Fig. 2.

is only slightly less than the length of the U-tube between the two extreme platinum wires, the change of potential at P, from E_2 to E_1 and conversely, can be made almost instantaneously. Hence measurements can be made with the instrument even if the zero is altering fairly rapidly. With a key of this kind it is also obvious that the observation of the meniscus through the microscope can receive a very near approach to undivided attention.

Commutators and keys which make a set of connections in a prescribed order can be constructed on the same principle as the pneumatic key described. Fig. 3 represents a combined commutator and electrometer key.

The U-tube to the left is the key already described, and the double U-tube to the right is the commutator. The positions of the different wires are so arranged with respect to the levels of the mercury that it requires greater pressure to change the contacts in the double U-tube than in the tube to the left. The first effect of pressure is to throw the electrometer into the potentiometer or other circuit, connecting P_1 with E_1, and P_2 with E_2. On increasing the pressure, the connections in the double U-tube are reversed and P_1 is coonected with E_2 and P_2 with E_1. Hence, when the contacts change in the commutator, we get a motion of the electrometer meniscus corresponding to approximately twice the difference of potential between E_1 and E_2, and so, in this way, the sensitiveness of the instrument is doubled.

The sensitiveness of the electrometer, using the simple key first described, is such that when the diameter of the wide tubes is about 1 cm. and the diameter of the capillary is about 1 mm., a movement of the meniscus perceptible with certainty in a microscope magnifying 100 times is produced by a potential difference equal to 0.0001 volt. The actual extent of the movement is somewhat variable, and amounts usually to about 0.01 mm.

The sensitiveness of 0.0001 volt, which is obtainable without any

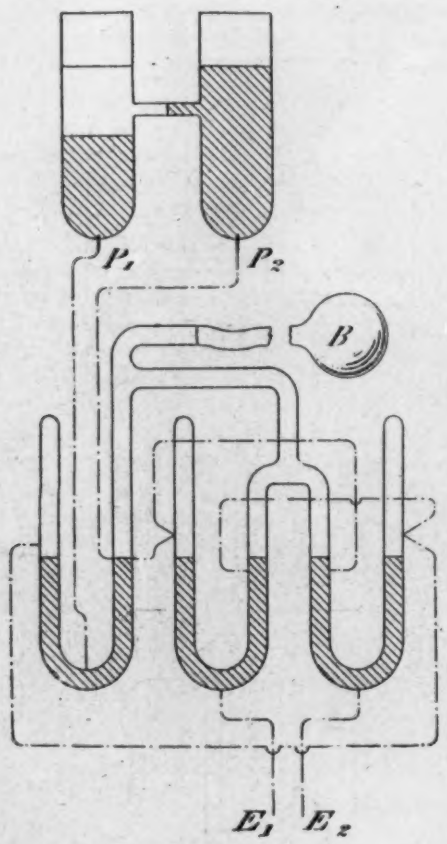


Fig. 3.

difficulty if the mercury is clean, is sufficient for a great many measurements in which the electrometer can be employed, and for these the electrometer (which for the purpose in question is really a surface tension galvanometer) is more convenient than an ordinary galvanometer with a suspended magnetic system. The electrometer is much more easily set up than an ordinary galvanometer. There is no suspension, no lamp and scale, and, practically, no leveling; but it is advisable when working with the instrument that the potential of E_1 should never be more than a few tenths of a volt less, or more than about a volt greater, than the potential of E_2. These conditions of working are, in general, not difficult to satisfy. If the potential differences applied exceed either of the limits previously mentioned, it is sometimes necessary to run some of the mercury through the capillary tube in order to get the instrument again into its best working order.

The accompanying photograph represents one form of the instrument

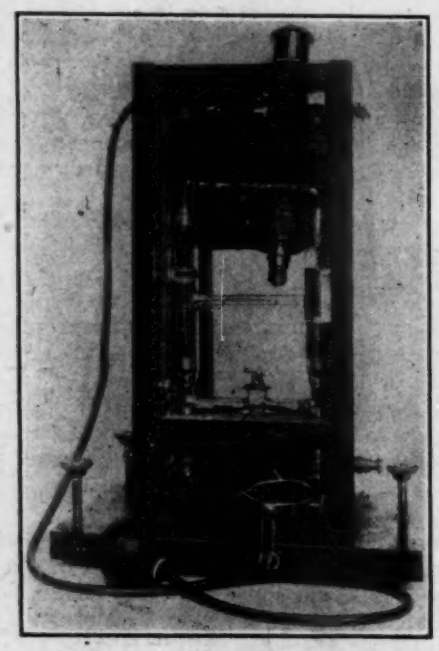


Fig. 4.—The Capillary Electrometer.

described. The arrangement of the different parts will be obvious from the description already given. The illumination of the end of the mercury thread is effected by means of a concave mirror attached to the base of the instrument.

The Textile Industry and Gas Power.

At the annual meeting of the New England Cotton Manufacturers' Association, held in Boston, Mass , some weeks ago, Mr. B. H. Thwaite read a paper on the topic named in the heading. The main points in his presentation were as follows:

The author began by saying he had had the privilege of perusing a paper on "Mud Fuel," contributed to the Berkshire meeting of the Association by Mr. E. Atkinson, who expressed the opinion that the wasteful steam boiler and engine would soon give place to the internal combustion or gas engine for all stationary power requirements; and he suggested that the "bog fuel" with which he had experimented would be suitable for making gas for driving engines. Mr. Thwaite went on to explain that this bog fuel differs very little, if at all, from peat, with which he had experimented for making power gas, which acted perfectly in an engine; the indicator diagram being almost the same as one obtained with poor coal.

In the year 1889, in the course of a lecture on "Mill Engines" delivered by the author before the Yorkshire College Textile Society, he expressed the opinion that there were no grounds for the prediction which had been made that the steam engine would become obsolete.

This opinion he had been compelled to change, in face of the irresistible evidence his own experience has produced. His investigations into the question of generating motive power by direct combustion commenced soon after he delivered this lecture; and in the course of them almost every available fuel was employed—wood, charcoal, peat or bog fuel, coke, coal, both anthracite and hydrocarbonaceous—and he found that all these fuels are available for producing motive power gas. The result of his work, and especially that associated with the utilization of the waste gases from blast furnaces for gas engines, has been to elevate these engines to a height above possible competition by the steam engine, whether rotative or reciprocating. One of the main issues from these investigations was the fact that, by the compression of the explosive mixture, a combustible gas of almost any thermal value above 50 British heat units per cubic foot can be employed in a gas engine.

This fact, once demonstrated, brought into the field of future service the enormous volumes of waste gases that flow into and pollute the atmosphere at every iron-making center. To meet the demand for engines to utilize this awful waste of power, many eminent engineers in Europe have for several years been applying almost their entire attention to designing engines to secure all the qualifications that a steam user and electric supply consumer must have; and in Germany alone it is said that upwards of 50,000-horse power of large-capacity gas engines are in active service. As a result of his success, he was permitted in 1897–8 to displace a steam engine by a gas engine in a textile factory near Leeds—a power gas generator of his design permitting the gas to be supplied from coke breeze. The power user of this plant has kept his engine in daily service for some six years, and he is, if possible, more enthusiastic now in his appreciation of this method of producing direct power than he was in the earlier stages of its operation.

An analysis of a gas engine's thermal or heat expenditure shows that from 20 to 30 per cent. of the heat supplied is converted into dynamic energy, 20 per cent. is carried away in sensible form by the exhaust gases, and the balance, after allowance for the effect of the increase of the specific heat with temperature, is absorbed by the jacket water. This water will be available for heating purposes. If steam is, however, required, the cylinder jacket water can be used as the agent of evaporation, and the steam can be generated by the combustion of the gaseous fuel in a suitable water tube boiler. In the application of the author's gas power system to the driving of a textile factory, the cylinder jacket water is used for dyeing purposes, the exhaust gases are used for warming purposes, and the sensible heat of the producer gases is utilized to heat the air required to support the gasification process and also for drying purposes. It is claimed that the process gives a return, either as power or heat, of 80 to 90 per cent. of the heat stored in the fuel used in the generator.

A typical thermal balance of everyday running is made up as follows; the expenditure including week-end stand-by losses, and the heat value of the fuel being 100:

Producer Gas Generation.	Per Cent.
Heat absorbed in gasification and radiation	10.0
Sensible heat returned by air heater or recuperator	9.0
Chemical heat value of producer gas in holder	81.0
	100.0

Gas Engine and Heating Appliances.	Per Cent.
Heat converted into work	18.5
Hot water from cylinder jacket used for dyeing purposes	44.5
Heat rejected as sensible	18.0
Balance absorbed in gasification	19.0
	100.0

The author gave the following particulars of a test made with his producer power gas plant driving a textile factory:

Diameter of cylinders	16 inches.
Length of stroke	24 "
Revolutions per minute	140
Explosions per minute	140
Mean initial pressure	297 pounds.
Mean effective pressure	78 "
Indicated horse power	133
Producer gas per hour, main	10,640 cubic feet.
Producer gas per indicated horse power per hour, main	80 "
Coke used per indicated horse power per hour.	0.99 pounds.
Actual carbon used, after deducting 15 per cent. of ash	0.74 "

The author closed his paper with the following remarks: Outside the question of thermal efficiency, there is a duty for all of us, and one that has hitherto been altogether neglected, but which it is a crime against natural laws to overlook. It consists in preventing, as far as it is possible, the smoke pollution of the atmosphere, a product of imperfect combustion. We all know that carbon completely oxidized to carbon dioxide by the process of combustion is in a condition suitable for absorption by the vegetable world, and supplies one link in the endless chain of Nature's wonderful scheme of the conservation of energy But, on the other hand, carbon dioxide gas, the result of the partial or incomplete oxidation of carbon, cannot be assimilated by vegetation, and is, moreover, a poisonous gas. Now, one of the greatest disadvantages associated with steam power is the fact that it is responsible for the major part of the atmospheric pollution which is proceeding day and night throughout manufacturing centers. The more or less complete removal of this is one of the advantages that can be claimed for gas power. The admirable Otto-Lenoir cycle of a modern gas engine, in which the gas and air are drawn into the cylinder together, and are there compressed to a high degree before being ignited, secures ideal combustion conditions; and the result is that the exhaust gases of any well designed engine indicate on analysis that more or less complete combustion is being obtained all through ordinary working conditions, and this almost independently of expert supervision.

Contents of the Question Box as Read at the Twentieth Annual Meeting, Ohio Gas Light Association, Cleveland, O., March, 1904.

Gas Manufacture.

No. 1. "How much water gas tar can be used in the water gas machine over the fuel bed as a partial means of enriching the gas?"

"On a 7-foot 6-inch water gas set, using 22 gallons of 28° gravity Texas crude oil, we have used (by pumping it over fuel bed in generator) 5 gallons per run. So long as tar lasted we put 17 gallons of above 28° oil into carburetter and 5 gallons of tar into generator.—E. C. White."

"*References:* American Gas Light Journal, Dec. 22, 1902, p. 902; Dec. 29, 1902, p. 949. *Journal of Gas Lighting*, Dec. 30, 1902, p. 1,754.—New York & Richmond Gas Company."

"About 20 per cent water gas tar. With a 6-foot Lowe machine ordinarily using 20 gallons oil per run, making 4,300 to 4,800 cubic feet of gas per run, use 16 gallons oil and 4 gallons tar. Have separate tank and spray for tar.—Chas. F. Cattell."

"About a ½ of a gallon of tar per 1,000 cubic feet of gas made can be used, provided a blast pressure of 18 to 20 inches is used on the generator. If a lower pressure of from 12 to 15 inches is used, the fire will not get hot enough to vaporize the tar and still get good results from the steam.—E. J. Sherwood."

"Have tried cold water gas tar, and tried it heated and sprayed over top of a Lowe generator, using Pocahontas coke for fuel. Although many efforts were made and many analyses taken, we failed to derive any benefit, while the checkers of the carburetter were quickly clogged up with carbon. This was some three years ago. Perhaps someone has had better results.—E. M. Osbourne."

No. 2. "What should be the relation in resistance in the generator, carburetter and superheater of a water gas machine? Assume the drop in pressure is 6 inches between the bottom of the grate bars and the top of the generator, what would be a fair drop in pressure for each of the other two shells?"

"The differential pressure of carburetter and superheater will, of course, vary in accordance with arrangement of brick and handling of machine. I have found on large machines a differential of 4-tenths for the carburetter and 18-tenths for the superheater. On another machine, almost as large, having a capacity of 1½ million feet, these conditions were almost reversed; the carburetter differential being 15-tenths, whereas the superheater threw only 5-tenths. With a generator throwing 6 inches differential, a drop of from ½ inch to 1 inch in each of the remaining two shells would be fair.—Henry I. Lea."

"This differs in machines of the same type and apparently built on the same principles. When in good condition the gauges step down like a stairway, varying from 2½ inches to 4 inches; generator being 18 inches, carburetter 14 inches and superheater 10 inches. Condition of checkers in carburetter and superheater, and condition and kind of fuel and clinkers in generator, have much to do in these relations.—E. M. Osbourne."

"In a modern Lowe setting, with bricks clean and spaced say 2 inches apart, the loss of blast pressure in the carburetter bricks should be from 2 to 3 inches, and in the superheater bricks from 3 to 3½ inches. The loss in pressure in the connections between these vessels and at the superheater stacks will be from 3 to 3½ inches. (See also reply to questions No. 13 and 14.)—Anonymous."

No. 3. "Is it better to alternate the running of a water gas run while making gas, or is it better to make one entire up run and then one entire down run?"

"No; according to best authorities.—Walter M. Blinks."

"From experience with two Lowe improved machines, 10-foot sets, we find that a continuous down run every fourth time is the most successful method.—W. S. Baldwin."

"It would strike me that reversing while the run is on would be aiming at a delicacy of operation that our knowledge of conditions of the fuel bed at any moment would not warrant.—Henry I. Lea."

"One down run in 5 or 6 is sufficient, and that should be a complete run, unless the generator fuel is bad and the clinkers get too high. In that case make the down run often enough to keep the clinkers down.—J. T. Mason."

"Experience has developed the fact that it is best usually to make 2 or 3 up runs and then a down run. The condition of the generator fire governs the proportion of up and down runs required.—E. M. Osbourne."

"Mr. W. C. Morris, East River gas works, Long Island City, made remarks upon this subject in a paper read before the American Gas Light Association at its meeting in 1903. Consult this paper.—Anonymous."

No. 4. "Is there any advantage in carrying a high boiler pressure for water gas making, and wherein does this advantage lie?"

"By carrying a high boiler pressure you deliver a dry, high temperatured steam to the generator, keep the fire in a better condition, lessen the percentage of carbonic acid gas and also make a saving in generator fuel.—J. M. Coles."

"In making water gas, it is advantageous to have as large a number of B.T.U.'s per pound of steam as possible, in order to carry as much heat as possible in with the steam that the run may be prolonged, but steam at 150 pounds gauge only contains 7-tenths of 1 per cent. more B.T.U.'s in total heat per pound than does steam at 100 pounds gauge; so the increase along this line is not material. Water contained in the steam requires 956 B.T.U.'s for each pound which is converted into steam; consequently, the percentage of water should be kept down. If superheating of the steam could be accomplished economically, this might add to the efficiency of the apparatus. The higher the boiler pressure the greater the tendency to leakage and losses, and maintenance costs are thereby increased.—C. H. Williams."

"Advantages in carrying high steam pressure—dry steam for fuel gas and even pressure for the oil spray.—E. W. Smith."

"There is a decided advantage in carrying a high boiler pressure in water gas making, owing to the fact that it is cheaper to put the lower fraction of the heat necessary for the water gas reaction into the steam in the boiler, and this fraction should be made as large as possible, thus depriving the heated coal or coke in the generator of less heat units per 1,000 cubic feet of blue gas produced. The higher temperature thus conserved will tend toward a greater and purer make from each blast. The actual advantage may be measured in the difference in heat efficiencies of a blue gas generator and a high pressure steam boiler.—CLARENCE S. LOMAX."

"There is a great advantage in carrying a high boiler pressure. When the steam is liberated into the generator, the pressure is lessened and the extra heat in the steam tends to superheat it and we, therefore, have a dry steam with which to make gas.—W. S. BALDWIN."

"Yes, the higher the pressure the better, as the steam is drier and will not kill the fire in the bottom of generator as quickly.—FRED. H. BECK."

"The only advantage in carrying high boiler pressure is to obtain dry steam. If you superheat your steam, 60 pounds is sufficient.—CHAS. F. CATTELL."

"The advantage derived from carrying high boiler pressure in making water gas is that the steam under high pressure is much hotter and drier and therefore does not reduce the temperature of the fuel bed so quickly. It takes less heat (and, therefore, less fuel) to break up high pressure steam into its elementary gases. The high pressure behind the steam also forces it further through the fuel bed, and prevents the fire from being killed at the beginning of the run.—LEONARD FITZGERALD."

"The one advantage to be derived from a high boiler pressure is the securing of the driest possible steam, and the avoidance of condensation and entrained water. There is also a saving of heat units which must be taken from the generator fire as a complement to the temperature of the steam before breaking it up prior to the formation of its respective gases. (On this subject see work of Harris and Dr. Bunte.) As a disadvantage to this high pressure a greater rapidity of rate of flow is secured, causing less diffusion of the steam throughout the carbon body, thereby creating less general and perfect contact between the constituents and the passing off of the steam undecomposed, thereby creating excess.—M. N. LATTA."

"The advantage of carrying a high steam pressure in water gas making is due to the fact that steam cannot be decomposed below a given temperature, and if the generator fuel must expend part of its energy in doing work which might be done to better advantage in the boiler, the period of gas making must be shortened in proportion. The actual working capacity of the generator is, therefore, dependent to some considerable extent on the temperature of the steam entering it.—HENRY I. LEA."

"Yes, it lies in the fact that higher pressure furnishes drier steam. Dry steam does not kill bottom of fire so quickly, hence less carbonic acid gas is made; also, the quantity at higher pressure is larger. This is more marked where up runs only are made, the drier steam permitting a longer run without clearing than the lower pressure steam. In practice, however, 100 to 110 pounds pressure is considered sufficiently high and to be about the proper point for economy. When steam drops to 60 or 75 pounds a decided falling off in make is noticeable, and an increase in the carbonic acid gas shown by analysis.—E. M. OSBOURNE."

"Practically the only superiority of high pressure over low pressure steam supply for water gas generators is that it permits the use of smaller piping and also gives increased steam storage capacity to the boiler. Since, however, steam from the same boiler will be used for engines, etc., for which purposes high pressure steam is far more economical than low pressure, a high pressure is necessary.—ANONYMOUS."

"The value of high pressure steam is undoubtedly over estimated. Steam at atmospheric pressure and 212° contains 1,178.6 B.T.U.'s, while steam of 120 pounds boiler pressure contains 1,220.4 B.T.U.'s, the higher pressure steam only having 41.8 B.T.U.'s more, or approximately 3½ per cent. more heat. Any practical advantage found in high pressure steam must be due to the presence of less water in the form of vapor. Superheating the steam at atmospheric pressure, adding less than 100°, would more than compensate for the additional heat contained in the 120 pounds steam which would have a temperature of 350° F., or steam at atmospheric pressure superheated to 312° F. ought to be more desirable and advantageous than 350° steam at 120 pounds pressure. It should be more economical to put this heat into steam in some other way than by generating heat in a boiler furnace and transmitting it through the shell of the boiler to the water. I doubt if many boilers in gas works yield an efficiency of 50 per cent.—EDITOR."

No. 5. "What is the difference between a regenerative furnace and a recuperative furnace?"

"A regenerative furnace is one in which the secondary air only is preheated. A recuperative furnace is one in which both primary and secondary air are preheated.—E. C. WHITE."

"A regenerative furnace is one in which the flow of the waste gases and secondary air alternates in passing through the recuperative flues. I know of no such a furnace in any coal gas plant. All the so-called regenerative furnaces are recuperative.—V. F. DEWEY."

"Difference in name; the better practice now is to speak of the furnace as regenerative and the heating passages for secondary air as the recuperators.—WALTER M. BLINKS."

"While the terms 'regenerative' and 'recuperative' are ordinarily considered synonyms, I believe 'rengenerative' applies more correctly to that type of furnace in which carbon monoxide is obtained as the result of two or more conversions in body of the fire; while 'recuperative' has more properly to do with the transfer of heat from the waste gases to the incoming air.—HENRY I. LEA."

"I fail to see any difference. They both utilize the heat of the waste gases after they have left the setting proper.—WALTER THOMAS"

"A regenerative furnace is one in which the air is pre-heated by passing through a chamber previously heated by means of the waste gases. It is an intermittent process. A recuperative furnace is one in which the air is pre-heated by passing through a chamber heated from the outside by means of the waste gases. This is a continuous process. —W. S. BALDWIN."

"There is nothing in the etymology of these words that would prevent their being used interchangeably in describing the two kinds of furnaces, but as I understand it an arbitrary distinction has been made in their meanings for this purpose, 'recuperative' being used to designate that class of furnaces in which the incoming air is heated by the outgoing products of combustion, each passing continuously in opposite directions; while the word 'regenerative' designates that class of furnaces in which the products of combustion are passed alternately in opposite or different directions, heating in turn the walls of two sets of flues or checkerbrick chambers through which the incoming air alternately enters.—IRVIN BUTTERWORTH."

"I believe there is no technical difference, as one name could be applied to one kind of construction as well as another in my opinion; but custom, at least with reference to gas retort benches, has settled the question by naming a bench where the products of combustion pass through one set of flues continually and the secondary air passes through another set of flues continually, said flues being in close proximity to each other and the air being heated by radiation from the flues containing the waste gases from the bench, a recuperator furnace. To my knowledge, there are no regenerator benches used in the United States. In this construction the two sets of flues or two chambers are used. A portion of the time the waste gases pass through one chamber and the air for combustion through another chamber. After a certain period the flues are reversed, changing the air from the flue through which it has been passing to the fine through which the gas has been passing and which has become heated. The waste gases are then taken through the flue formerly used by the air, and which has been cooled down by it, thus again heating it up. This requires a constant changing of the gases and air from flue to flue. Said construction is used in heating furnaces for steel work, etc., and they are called regenerator furnaces.—D. R. RUSSELL."

"A recuperative furnace is one in which the air for combustion is pre-heated by passing through a flue, or set of flues, without reversal in direction and continuously; the transfer of heat being accomplished through the walls of the flues. A regenerative furnace is one in which the air for combustion is pre-heated by passing through a flue, or set of flues, previously heated by the passage of waste gases through them. The transfer of heat is accomplished by the contact of the incoming air with the hot flue. After the flues have been cooled by the incoming air the same is admitted through another set of flues previously heated by the waste gases, the waste gases then being turned back into the first set of flues for the purpose of reheating them. It is not necessary that any reversal of direction of flow should take place, although such is usually the case.—W. A. BAEHR."

"Some standard nomenclature should be adopted to designate furnaces. The generator adopted by Siemens is not used in bench co

struction, and our ordinary bench is properly a producer-recuperator furnace.—EDITOR."

No. 6. "What is the difference between a half-depth bench and a ¾-depth bench?"

"For benches using 5 or 6 retorts the half-depth furnace has been found sufficient, obtaining the same economies in fuel and costing less for erection than the full-depth furnaces. On benches of 8, 9 and 10 retorts the ¾-depth furnace must be used to obtain the full benefits of recuperation. I am now designing benches with 10 retorts using pulverized fuel, upon which I have applied for patents. With this mechanical device we shall do away with the old system, using, however, hot air from the secondary air supplies with the blower.—O. B. WEBER."

"A half depth bench has a fuel bed 3 feet deep, the bed of a full depth furnace is from 5 to 6 feet deep, and the three-quarter will naturally be the mean between the two.—WALTER M. BLINKS."

"No difference except in dimensions of furnace We have full-depth regenerators here and ½-depth. Depth of fuel, full-depth, 72 inches; depth of fuel, ¾-depth, 54 inches; depth of fuel, ½-depth, 36 inches. Of course, this varies according to the ideas of different engineers. I have erected what was considered full-depth fuel on 60 inches, but much wider.—WALTER THOMAS."

"No difference. No such thing as three-fourths' depth bench.—V. F. DEWEY."

"A half-depth bench is one in which only the secondary air passes through a process of recuperation. A three-quarter depth is one where the primary air is given a partial process, while the secondary receives its process of recuperation.—C. H. WILLIAMS."

"There should never be such a name as a three-quarter depth bench. If the primary as well as the secondary air is pre-heated, then the bench is a full-depth beuch. If only the secondary air and not the primary air is pre-heated, then it is a half-depth bench.—W. S. BALDWIN."

"A half-depth recuperative bench is one in which the secondary air only is pre-heated. A three-quarter depth recuperative bench is one in which either the secondary air only, or both the secondary and primary air, are pre-heated, but there is no clear, distinctive feature to mark such a bench decidedly in a class by itself. It seems to exist only as a slightly deeper recuperator than a half-depth, or a slightly shallower recuperator than a full-depth bench. I regard the term as a very unfortunate one, and it should be eliminated. The builders who originated the term three-quarter depth did so largely because they found in a great many gas works the retort houses were not as high from the cellar floor to the charging floor as their standard, full-depthbenches called for. These same builders had standard half-depth benches in which that same height was figured much lower than the height found in these old works. The result was that they designed a so-called three-quarter depth bench, which is distinguished, as previously noted, from the full-depth and half-depth benches merely in height, and as such there is no clear distinction whatever. In place of making a distinctive feature in such a bench in the line of some particular point concerning preheating of the air, or something similar, the builders have simply made the distinction by the vertical dimension from their usual standard plans. The gas profession as a whole cannot countenance such a distinction in my opinion, and I would say that their so-called three-quarter depth bench, if the secondary air only is pre-heated, should properly be called a half-depth bench, and if both the secondary and primary air are pre-heated it should properly be called a full-depth bench.—W. A. BAEHR."

No. 7. "What temperature is required to gasify gas oil?"

"In answering the question I may say in general that gas oil is a composition sometimes fearfully and wonderfully produced, but as such, from Ohio or Pennsylvania fields, of a gravity of about 35° B. (which by the way determines very little and means almost nothing as regards the quality of gas oil), reaches the point of complete vaporization at 700° to 750° F.; and Texas gas oil from Beaumont field, showing a gravity of 26° to 28° B., reaches complete vaporization at 650° to 700° F. As I interpret your question, the above temperatures will cover the answer. If the inquiry should mean at what temperature does gas oil vapor combine with the water gas to become a commercial fixed gas this is quite another matter. Up to the present gas oil has been so varied in its composition that it would be almost an impossibility to name a temperature with any degree of certainty that would cover the question.—W. E. BARRETT."

"I have had the best results at about 800° to 825° C.—CLARENCE S. LOMAX."

"From 2,000° to 2,200° F. are required to thoroughly gasify gas oil.—FRED H. BECK."

"Mr. A. G. Glasgow, in his paper The Practical Efficiency of an Illuminating Gas Setting (see American Gas Light Association Proceedings for 1890), gives the temperature of the illuminating gas at the superheater outlet at 1,450° F. This probably represents the maximum temperature at any time attained by the gas, although the brick in the carburetter was probably of considerably higher temperature. These experiments were made on a double-superheater Lowe set. Crude oil was used.—ANONYMOUS."

No. 8. "How can clinkering in a water gas generator be prevented or lessened?"

"To prevent clinkering, reduce the blast pressure on generator. This, generally speaking, answers the question, but much depends on the kind of coal used and also on the gas maker himself. First, select a good coal that would, after different trials, prove to be tough rather than brittle when exposed to high temperatures; that is, a coal that would stand the blast without slacking or breaking up in the generator. It should appear like big, red-hot stones on top when ready to coal up. Secondly, in a plant where a machine is not running continuously, it should be gradually worked up to a proper heat before forcing it. Some gas makers are apt to use too much steam, thereby drowning out the fire and making a poor quality of gas, the tendency being to make quantity rather than quality. A great deal of this, of course, condenses again if not properly fixed, increasing the percentage or leakage or shrinkage of holder gas. Briefly, my experience is, to first work the machine up into good condition for gas making, being careful not to use too much steam; hence, the heats can be maintained and more fixed and better gas turned out, at the same time running with less blast pressure, thereby reducing the formation of clinkers.—CHAS. F. CATTELL."

"By alternating the steam in the middle of each run the clinker is lessened and more gas is made per run.—J. M. COLES."

"Clinker is ordinarily formed in the water gas generator largely because, in blasting, many inequalities are produced in the fuel bed, some portions becoming much hotter than others. As the air passes more readily through the hottest portion of the fire and the steam through the coldest, these varying temperatures are doubtless encouraged; certain portions of the fire are, therefore, exposed to temperatures considerably higher than necessary. These troubles are overcome by uniform distribution of the blast under the grate, thus bringing about uniform temperatures and carrying the body of the fire much closer to the grate than is possible with the ordinary blast arrangement. The divided blast, in connection with barring up between clinker periods, renders unnecessary the use of steam for the rotting of clinkers.—HENRY I. LEA."

"By the use of coke breeze around the edge of the generator we find that the clinker on the sides of the generator is greatly lessened.—W. S. BALDWIN."

"As the formation of clinker is dependent on the nature of the fuel, the blast, steam and proportion of down runs used therewith, no rule other than thoughtful experiments and application of results observed can be given. The writer has thought that a flux could be used to advantage with such a coke as Tom's Creek, which under all conditions furnishes an iron clinker on the bars, but as suitable fuels have been available the experiment has not been made.—H. L. RICE."

"By proper fuel and right management of generators. This done, no clinkers save at bottom should occur. Have cured a so-called bad clinkering generator by placing another operator in charge of machine; this without change of conditions. Too strong a blast after bottom of generator has been cooled for 8 or 10 minutes by steam has a tendency to cool it; hence lighter blast is followed by increased pressure after being on 2 or 3 minutes.—E. M. OSBOURNE."

"The most usual method of preventing excessive clinkering in a water gas generator is by the judicious use of steam. As I understand it, the object of up-and-down runs, or putting the steam alternately above and below the fire, is to keep the fire in good condition by softening up and breaking the clinker which has a tendency to form at the point of extreme heat, which would ordinarily be on top, as the blast is always from the bottom towards the top. High blast pressure also has a tendency to increase the clinker, and as the advantages of high blast pressure are recognized in increasing the make and oil efficiency, the tendency to clinker must be overcome by making more down runs. Another important point is to see that the generators are thoroughly cleaned and all clinkers removed from the side walls of the generators

at least once a day. The fuel lost in thoroughly cleaning the generators at least once a day will be more than made up by the increased results obtained in starting out each day with an absolutely clean fire. I am convinced that in many small works where the superintendent is not always on the ground, the matter of thoroughly cleaning the fires does not receive the attention that it should.—J. S. DIXON."

"Clinkering in a water gas generator can be prevented or lessened by putting a layer of slaked lime or oyster shells on the top of the fire, around the lining of the generator. This should be done once or twice a day.—E. P. GARTLAND."

"By exercising good judgment in use of force draft; also care should be taken in the use of steam under the fuel bed.—E. W. SMITH."

"The formation of clinker in the generator is, of course, greatly increased by undue heating of the fire. It can be prevented by shortening blows to the proper point, and also in the case of 'reverse steam' apparatus, by experimentally adjusting the ratio of up and down runs; if bad clinker is found to exist for instance at the bottom of the fire, decrease the proportion of down runs.—ANONYMOUS."

No. 9. "What is the temperature of the gaseous products in the top of the generator during the gas making period?"

"The following tests were made after cleaning a fire that had been in use for 6 hours. The period of cleaning was 2 hours in length. The cleaning was done from the side doors first, and while cleaning from the front door the fire had an opportunity of brightening up under natural draught. At this time, after the generator had been open nearly an hour, the temperature at top of generator was 1,000°. The following table will show the temperature at various points in the apparatus during the blow and run:

		First Blow			Run	
Where taken.	Begin.	5 Min.	8 Min.	10 Min.	4 Min.	8 Min.
Top of generator...	....	1,500°	1,950°	1,950°	....	....
Top of carburretter.	1,000°	....	....	1,600°	1,400°	1,000°
Sight-cock of carburetter.....	900°	....	....	1,400°	1,200°	1,100°
Sight-cock of superheater.....	800°	....	....	1,250°	1,100°	1,000°
Top of superheater.	700°	....	....	1,100°	1,000°	900°

"During 4 runs of 8 minutes each with 5-minute blows, the temperature at top of superheater did not go below 900°, but varied a little, fluctuating between 900° and 1,000°.—FRANK LANGWITH."

"About 1,600° F.—V. F. DEWEY."

"1,600° to 1,610° F.—DONALD DAVIDSON."

(To be Continued.)

Making Concrete Water Tight.[1]

The increasing use of concrete for tanks and reservoirs and in various kinds of conduit and subway work, is attracting the attention of engineers to means for securing water tight construction. There have come to us recently a number of inquiries as to how a water tight or impermeable concrete might be secured. Generally the writer asked for some kind of efficient waterproofing, or else desired to know how this or the other kind of proposed waterproofing material would serve under stated conditions. These are very important questions, and by the same token they are very difficult questions to answer. The height of this difficulty is hardly appreciated in fact until one undertakes to seek and co-ordinate the knowledge that is available on the subject in technical literature. In view of this it may serve a good purpose to review briefly the means that have been employed to make concrete water tight.

Tightness against penetration by water is chiefly important in two classes of structures, those whose purpose it is to inclose a space which, to serve its purpose, must be kept dry, and those whose purpose it is to confine liquids. Subways for pipes and wires and underground railways belong to the first class defined, and tanks, aqueducts and sewers are the chief representatives of the second class. The degree to which tightness is a requisite of any of these structures depends upon the individual circumstances. In underground street railways it is essential not only that the penetration of water be avoided, but also that dampness should be prevented. For aqueducts it is usually not necessary to go further in securing tightness than to make sure that the leakage is not a calculable drain on the supply of water that passes through the conduit. These are the practical desiderata; practically, absolute tightness is only an ideal toward which the engineer aims. So long, therefore, as the engineer meets the practical requirements for water tightness in his works, he is doing all that good engineering requires. To strain for further perfection verges on dangerous ground if we define engineering as the art of making a dollar earn the most interest. This thought has been emphasized here because several recent discussions on water tight concrete have shown a hypercritical spirit; because various prevailing methods of rendering concrete tight against water are not perfection, they are classed as useless. This conclusion is quite as vicious as would be the opposite conclusion that partial perfection is perfect enough.

Starting with the purpose merely of doing the best that is to be done, there are open to the designer and builder of concrete work two paths for reaching water tight construction. The first is to employ some form of waterproofing, and the second is so to manufacture the concrete that it is impermeable. In actual practice less attention has been paid to developing impermeable mixtures of concrete than has been given to the use of waterproof coatings, probably because possible modes of solving the problem in the last mentioned manner readily suggested themselves, while the searching out of an impermeable concrete mixture bade fair to be an intricate task. However this may have been, the fact persists that most attempts to secure water tight concrete have been attempts at waterproofing.

The most common form of waterproofing has been some kind of asphalt coating used sometimes alone and sometimes in combination with tarred or asbestos felt. When felt and asphalt are combined, they are laid in alternate layers on a concrete bed and then are covered with the remainder of the concrete; the layer next the concrete in both cases being asphalt. There are generally from three to six layers of felt. Asphalt for this work is always the best grade of Bermudez or Alcatraz lake asphalt, and the felt is usually asbestos felt for points below ground water level, and tarred felt for points above this level. This style of waterproofing has been extensively used in underground railway work in New York and other cities, and is generally regarded as being of unusually high quality. Its ultimate durability is unknown.

For ordinary work the asphalt coating is usually formed without felt, and consists either of asphalt alone or asphalt mastic. When asphalt alone is used the concrete surface is first plastered with rich mortar on which the asphalt is mopped to a thickness of ¼ inch, and then plastered over before depositing the remainder of the concrete. Asphalt mastic is usually laid directly on the concrete and covered directly by the remainder of the concrete. The coat is usually about ¼ inch thick. These forms of waterproofing have been much used in waterproofing gun inclosures and magazines in fortification work.

The Government engineers have also successfully used a waterproofing wash composed of an alum and lye solution mixed with cement in the proportion of 1 pint of solution to 5 pounds of cement. The solution itself is composed of 1 pound of concentrated lye, 5 pounds of alum and 2 gallons of water. This wash is applied with a brush and well rubbed in. In this same category may be included the so-called Sylvester wash and the water glass washes so long familiar to engineers.

In Europe where many tanks and conduits have been built of reinforced concrete, the only waterproofing used is a layer of rich cement mortar coating about 1 inch thick. This mortar coating is preferably built up with the concrete and is placed on the inside. A cement grout wash applied with a brush is the standard waterproof finish in America in ordinary cement cistern work. For pressures of over 50 feet head, the European manufacturers of reinforced cement pipe conduit consider that a sheet steel lining is necessary in order to make the pipe water tight. These cast pipes have very thin shells, however, and for heavier conduit the only precaution taken is to use a wet mixture and make the inside layer of mortar. Recently in America the practice in waterproofing the arch ring and spandrel walls of arch bridges, has been to give them a plaster coat of rich cement mortar. For tank and conduit work, generally, experience in both Europe and America indicates that all practical requirements for water tightness are secured by a wet mixture and a cement mortar coating.

Turning now to the possibilities of making concrete impermeable, we find that a number of experiments have been made on impermeable concretes, both in Europe and America. In these experiments the object sought has been either the determination of a mixture of cement and aggregates that would resist the percolation of water or the discovery of a substance which by admixture with the concrete materials would render the hardened product impermeable.

The elaborate tests of Mr. R. Feret, of the Boulogne Laboratory of the Ponts et Chausees, extending over five years, led him to the following conclusions:

1. *Engineering News.*

That in all mortars of granulometric composition, the most permeable are those which contain the least quantity of cement.

Of all mortars of the same richness, but of varying granulometric composition, those which contain very few fine grains are much more permeable. They are the more so where, with equal proportions of the fine grain, the coarse grains predominate more in relation to the grains of medium size.

The minimum permeability is found in mortars where the proportion of medium size grains is small, and the coarse and fine grains are about equal to each other.

Mr. Feret's experiments also showed that the permeability of mortars submitted to a continuous filtration of fresh water or sea water diminishes rapidly with time. He also recommends using a too large rather than a too small quantity of mixing water.

A series of experiments made by Mr. G. W. Hyde and W. J. Smith, in 1889, on the permeability of mortars and concretes, showed that with the same proportions of cement, mortars made with fine sand are less permeable than those made with coarse sand; that with the same quality of sand, permeability increases as the proportion of cement increases; that mortar made with good cement is less permeable than any cement and sand mortar.

A third set of tests to determine the permeability of concrete under high water pressures, show results which are in general similar to those already stated. These tests were made by Mr. J. B. McIntyre and A. L. True at the Thayer School of Civil Engineering in 1902, using 1-1, 1-2 and 1-3 Portland cement and sand mortars. The conclusions drawn from these experiments were as follows:

From the tables it will be seen that several of the mixtures were practically impermeable to water at the pressures which we had at our disposal, nearly from 20 to 80 pounds per square inch.

All the specimens composed of 1:1 mortar in the proportion of 30, 35, 40 and 45 per cent. of the whole mass were impermeable. Some of the specimens composed 1:2 mortar in the proportions of 40 and 45 per cent. were also impermeable, as well as the mixtures of 1:2:4 and 1:2½:4.

All others leaked at the high pressure, and in a general way may be said to have shown a degree of imperviousness in direct proportion to the proportion of mortar in them, with the lower pressures, as well as with 80 pounds.

In a number of instances it has been found that water percolating through concrete absorbed lime in its passage which was deposited on the exterior surface of the concrete in the form of an efflorescence that acted as a very perfect seal against further percolation. These experiences have been taken by a number of engineers as the basis for a theory that slacked lime added to the concrete mixture would serve to make it impermeable. Mr. R. W. Lesley, Assoc. Am. Soc. C.E., advocated this practice in a discussion before the American Society of Civil Engineers in the following words:

The speaker's theory and conclusions, based upon all that has been discovered, and especially upon Feret's remrakable experiments, would seem to indicate that the best addition to cement mortars for the purpose of making them impermeable, according to the theory of an exterior coating by lime carried through the mass during filtration, would be to add to the concrete, at the time of mixing, a reasonable proportion of hydrate of lime, or, in other words, the ordinary slaked lime of commerce. This slaked lime, as has been shown by experiments of the late Prof. De Smedt, formerly of the Laboratory of the District of Columbia, does not injure cements or mortars, does not cause expansion, and does not decrease their strength, though retarding their setting slightly. Such an addition would be perfectly safe, as a matter of practice, and would form in the mass a substance which would be carried by filtration and close the pores, form efflorescence or stalactites and stalagmites on the surface, and, in the speaker's judgment, though he knows of no experiments on the subject, would aid largely in making mortars impermeable. Experiments in this line would be most valuable.

Other substances which have been mixed with the concrete materials to render the hardened product impermeable to water are silicate of soda or water glass and soap and alum. Experiments conducted by Prof. W. K. Hatt to determine the effect of these substances on concrete, gave the following results:

The effect of silicate of soda is to diminish the strength of both ash and sand mortars more than 50 per cent., and to diminish the absorption of the ash mortars about 50 per cent. The effect of alum and soap mixed in with the mortar at the time it is gauged is to strengthen and harden the ash mortar about 50 per cent. and to diminish its absorption by 50 per cent. A soap solution alone will diminish the absorption (by the action of the alkali in the cement on the soap) but will not increase the strength. The strength of the sand mortar is not greatly affected by the soap and alum, but its absorption is decreased about 50 per cent. The effect on the absorption was measured by comparison of the weight of water taken up by briquettes which were immersed after having been dried out. Check tests were made by measuring the water which percolated from the outside through the walls of hollow cylinders. The speaker believes that this is the first use of a soap and alum solution for waterproofing, in place of the usual gauging water. The method used by the speaker is as follows: A 5 per cent. solution of ground alum and water is prepared; and a 7 per cent. solution of soap and water. The alum solution is mixed with the mortar to the amount of one-half the ordinary gauging water. The soap solution is then applied in amount to bring the mortar to the desired plasticity. The soap and alum, acting together, cause the precipitation of an insoluble compound in the pores of the mortar.

The neatest solution of the problem of securing water-tight concrete work is without doubt to use a concrete which is itself impermeable instead of resorting to waterproof coatings. This should be the end to which students of the subject should direct their efforts. At the present time our knowledge of impermeable mixtures is too limited to warrant definite recommendations for all conditions. It seems quite certain, however, that engineers will accomplish all that practical requirements necessitate in the great bulk of concrete work where percolation and leakage are to be avoided if they use a moderately rich concrete, mixed wet and coated on one or both faces with a thickness of mortar.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MESSRS. LINDSAY & CO., of Chicago, inform us that in their St. Louis establishment, 1113 Pine street, they will at any time, and especially during the meetings of the Western Gas Association and of the Congress of the Gas Associations of America, June 14th to 17th, at the World's Fair, be pleased to have the visitors make any use they see fit of the Company's quarters. Mr. W. W. Martin will be in charge.

A CORRESPONDENT in Seattle, whose word may not be truthfully disputed, writing under date of the 23d inst., says: "The consolidation of the Seattle Lighting Companies is now a matter of record. The Citizens Light and Power Company and the Seattle Gas and Electric Company are operating under one ownership, under the title of the Seattle Lighting Company. Ten months of quite 'strenuous' life sufficed to bring about the consolidation which naturally followed conciliation. The officers are as follows: President, J. D. Farrell; Vice-Presidents, J. W. Clise and L. C. Smith; Treasurer, G. A. Dounce; Secretary, H. R. Clise; Manager, Charles R. Collins. As the first result of the consolidation the gas mains will be extended, not only in the city proper, but also in the suburban districts. The two gas plants have been connected by means of a trunk main for the purpose of improving both manufacturing and distributing conditions. The Company's new offices are models as to convenience and elegance. The termination of this Seattle dispute seems to reflect a good bit of penetrating light on the sturdy caliber of Mr. C. R. Collins."

AT the annual meeting of the Consumers Gas Company, of Reading, Pa., the Directors elected were: Samuel D. Bodine, Wayne McVeagh, Richmond L. Jones, Walton Clark and L. T. Custer.

THE plant and franchises of the Paris (Ills.) Gas Light and Coke Company were offered for public sale by the Receivers, Messrs. G. E. Levings and John C. Risser, at the date and time advertised in the JOURNAL. The properties were knocked down to Mr. John E. Parrish, who acted for the bondholders and Mrs. S. M. Powell, at his bid of $50,000. The bonds amount to $40,000, and the claim of Mrs. Powell is something over $6,000.

THE Massachusetts Board of Gas and Electric Light Commissioners has named June 9th, as the day on which it will hear testimony respecting the petition of certain residents of Newburyport for a reduction of the selling rates for gas charged by the Newburyport Gas Company.

THE proprietors of the Quincy (Ills.) Gas and Electric Company have ordered that the rate for illuminating gas shall be reduced to $1 per 1,000 cubic feet, which rate for a supply on fuel account has ruled for some time.

MR. F. H. CORSON has been appointed Superintendent of the New London (Conn.) Gas and Electric Company.

THE proprietors of the Geneseo (N. Y.) Gas Company, in accord with an earlier note in the JOURNAL, have determined on making extensive betterments on the plant this year. In fact they have given a contract for all the machinery required for the new coal gas plant to the Gas Machinery Company, of Cleveland, O. The Geneseo owners will put down quite an addition to the Company's main system.

MR. CHARLES A. CROSS, for 20 years or more Superintendent and Engineer of the Williamsburgh works of the Brooklyn Union Gas Company, Brooklyn, N. Y., has resigned his position on account of ill health. Mr. Cross went to the Williamsburgh works in 1881, as assistant to that King of American gas engineers, the late Mr. Joseph Russell Thomas, and was appointed his successor in 1883, at the time that the present H. H. Rogers and his confederates were scheming to secure control of the Williamsburgh works at "60 per cent." Mr. Cross' administration of a very well built plant, many of the details of which Mr. Cross acceptably planned and capably carried out, has been satisfactorily accomplished to the date of his resigning, and it is with good regret that his friends will know that ill health alone obliged him to relinquish a post the planting point of which he knew so well. The employees of the works, just prior to his leaving them, presented Mr. Cross with a handsome gold watch, and an engrossed set of resolutions that will, while he lives, bear testimonial to the thoughts of the men whom he so carefully directed. Let us hope that Mr. Cross' retirement from active business will bring to him relief from work that he performed so faithfully and well.

WE understand that Mr. Cross' successor at the Williamsburgh branch is Mr. H. C. Slaney, formerly in charge at the Equity branch, which plant may be traced to the buzzard-like progenitors of Messrs. Devlin, Fanshawe & Co.

THE Pintsch Company is erecting a building for the covering of one of its plants, at Lycoming and Locust streets, Williamsport, Pa., for the purpose of supplying illuminating gas to the passenger coaches of the Pennsylvania Railroad Company arriving at and departing from the named point.

MR. W. T. CARTWRIGHT, of Canton, O., has been appointed Superintendent of the East Ohio Gas Company vice Mr. W. W. Richardson, who has been named General Superintendent of the Buffalo (N. Y.) Natural Gas Fuel Company, "etc."

WE are in receipt of a handsome copy of the handsome book-pamphlet, recently issued by the Consolidated Gas Company, of New York, which has to do in striking style with the uses to which gas may be applied for other purposes than lighting. It may look and sound like the recounting of local prejudices, when it is said that this book-pamphlet is at least equal to anything respecting similar matters that we have received from other sources, and if so it will certainly seem ultra when we say that it is the cleverest thing in its line that we have ever received. The misleading title, as we now read it, all on account of a mysterious leading "mixed initial," is "Making (or Baking) the Most of Life," does not mislead when one goes into the pages of illustrated description that are between the covers. It is up-to-date in every sense for its purpose, and Superintendent W. J. Clark and his associates are to be well congratulated on the work that they so well put together.

A CORRESPONDENT in Providence, R. I., forwards the following: "The Superintendent of the Norwich (Conn.) Municipal Lighting Company, to which the property of the present local gas and electric lighting supply will be turned over July 1, will be Mr. Francis S. Thayer, now Superintendent of the Westerly (R. I.) Gas and Electric Light Company. Mr. Thayer is well equipped for his duties. He was for 12 years with the Narragansett Electric Light Company, of Providence, R. I., for the greater and latter part of which time he had charge of the Company's gas plants in Bristol county, the main ones thereof being in Warren and Bristol, R. I. He is in every respect competent to assume his new duties."

MR. THAYER'S successor at Westerly will be Mr. Fred. N. Clarke.

MR. FREDERIC EGNER has removed his office headquarters from Washington, D. C., to Norfolk, Va.

THE Le Roy Hydraulic Company, the Le Roy Gas and Electric Company, and the Le Roy Power and Milling Company, all of Le Roy, N. Y., will hereafter be legally known as the Le Roy Hydraulic Electric Gas Company, a title that has more or less of suggestiveness.

THE New England Gas and Coke Company is seemingly inclined to "peddle its rights" to other New England towns. Providence is one place and Bridgeport is another wherein it would like to get the pottage. We do not know much about its chances in Providence for a sale, but our belief is that it will have a pretty hard time in Bridgeport in respect of realizing.

THE gas interests of Rome, Ga., are now under control of a concern known as the Rome Municipal Gas Company, whose owners are said to be residents of New York. The change is said to be subject to another shift, that soon will be made known.

A CORRESPONDENT in Louisville, Ky., forwards the following: "The Louisville Gas Company is not acting beyond its charter powers when it guarantees the principal and interest of bonds of the Louisville Lighting Company to the extent of $770,000, which it proposes to sell to four local financial concerns. Such was the decision rendered recently by Judge Samuel B. Kirby. The question arose recently when the Fidelity Trust Company, the German Bank, the Kentucky National Bank and the German Insurance Bank offered to buy from the Louisville Gas Company this amount of Louisville Lighting Company's bonds provided the Louisville Gas Company would guarantee them. With this guarantee the purchasers offer a premium of $20 on the thousand. The old Louisville Gas Company was practically controlled by the Louisville Gas Company, and when it merged with the Citizens Electric Light Company, forming the new Louisville Lighting Company, the Louisville Gas Company held bonds of the new corporation to the amount of $1,600,000. The necessity of raising money led to the proffer of $770,000 worth of these bonds to the four concerns named, and the question arose as to whether under its charter the Gas Company could guarantee the bonds of the other corporation, thereby increasing its actual liabilities beyond the maximum indebtedness provision of the charter. Judge Kirby in his opinion says in part:

"'In the case at bar the plaintiff had the right to create the debt of $770,000 which it owes the defendants. It had the right to acquire the bonds amounting to $1,600,000 issued by the Louisville Lighting Company.

"'It had the power and authority necessary for the manufacture, distribution and sale of electricity for illumination, and to that purpose may purchase, hold or sell all real and personal property, including stock of other companies, necessary or convenient to the conduct of such business.

"'It must provide some means for the payment of the debt it owes to the defendants. Shall the court say that this corporation owning these valuable bonds must force them on the market, to be sold for such price as they may bring, a price much less than their actual value, or shall the court say that it has the implied power and authority to make the best sale possible of these securities? It seems that there can be but one answer. If it has the right to hold these bonds, the right to sell them, and is under the duty of paying the debt, it has the right and power to sell them at the best advantage, and if by guaranty extending over a short term of years it can give enhanced value to these bonds, it would clearly be the duty of the court to so hold.'

"The case will be appealed immediately in an effort to have the Court of Appeals pass on it before the summer adjournment. The bonds are 5 per cent., maturing in 50 years, and the proposed guarantee includes that of all interest coupons falling due up to and including October 1, 1918."

Iron Age reports that the Mexican Light and Power Company, Limited, of Montreal, Can., recently placed in this country an order for copper cable for transmission, which is probably the largest single order for transmission cable ever placed. The order calls for 1,500 miles of cable, equal in carrying capacity to 3/0 B. & S. gauge, and weighing approximately 4,200,000 pounds. The cable is to be used on the Nicaxia-Mexico power transmission line, now under construction, and it will be supported on steel towers in spans of 500 feet. The length of the spans, together with the necessity of reducing the dip as much as possible and the high wind pressure to be withstood, made the matter of cables one of considerable importance. The cable was designed by W. G. Clark, of Seattle, Wash., electrical engineer.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance
Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 6, 1904.

The Market for Gas Securities.

There is not a market for anything in the securities line just now, and traders for the short account, who deal in small lots, are practically in control of the situation. As a result of their efforts prices have been on the down track. In common with other shares, Consolidated gas was weak, the low point in it having been reached yesterday (Thursday), and to-day the recovery was not marked, the closing quotations being 203¼ to 203½. On the 2d inst. the shareholders ratified the recommended issue of $20,000,000 convertible 6 per cent. debentures, bringing the capital up to $100,000,000. The debentures are to be dated the 1st prox., and will be payable in cash July 1, 1909, unless earlier converted into stock. Interest is payable semi-annually, and the bonds may be convertible into capital stock at par, July 1, 1907, or on any later interest date prior to July 1, 1909. Debentures then existing will be bought for cash. The rights are in good demand.

Brooklyn Union is nominally 210 to 225, which look low figures for a 10 per cent. investment stock, the business of the Company being confined to the second largest factor in Greater New York. Peoples, of Chicago, is steady, as also is Baltimore Consolidated. The lighting situation in Seattle has been settled, and the bond issues concerned therewith are in good demand. Laclede preferred is unchanged, and U.G.I. Company's shares are likely to show a substantial gain before August 1st. Louisville (Ky.) Company's bonds are 5 points higher than they were last January.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 6.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	203¼	203½
Central Union, Bonds, 5's.	3,000,000	1,000	106½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	105½	106
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	31	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's.	1,250,000	1,000	102½	105½
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109½	111
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	13
Preferred	5,000,000	100	145	1.5
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	210	225
" " Bonds (5's)	15,000,000	1,000	118	115
Bay State	50,000,000	50	⅛	3/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	3¾	4
" " Bonds, 5's	5,250,000	1,000	12¾	..
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104½
Cincinnati Gas and Electric Co	29,500,000	100	100¾	101¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101¼
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	70	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	341,000	1,000	75	75½
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	85	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	255
Hudson County Gas Co., of New Jersey	10,500,000	..	67	68
" Bonds, 5's	10,500,000	..	103½	104½
Indianapolis	2,000,000	..	60	70
" Bonds, 6's	2,650,000	..	103½	106½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	100
Preferred	2,500,000	100	80	100
Bonds	10,000,000	1,000	109¼	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	95	96
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58¼	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	286¼	288½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	.	..	..
Wilmington, Del.	600,000	50	230	..

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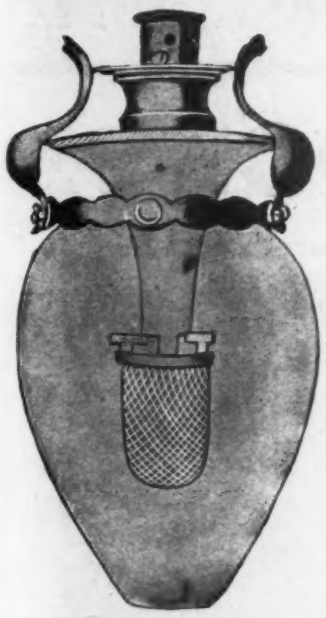

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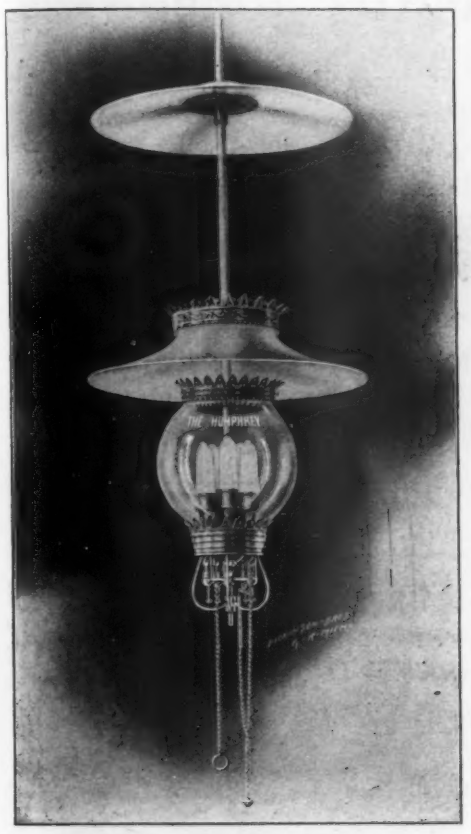

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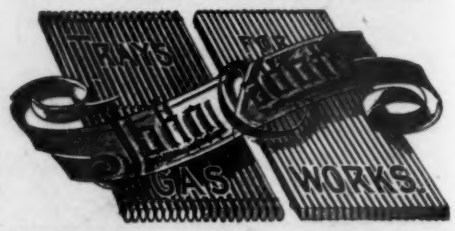

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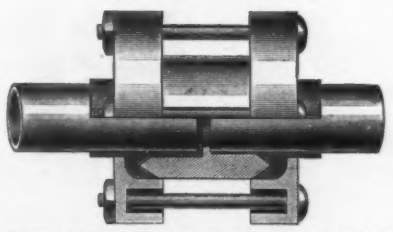
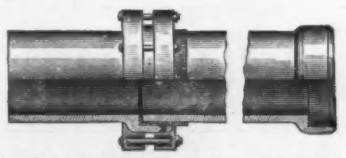
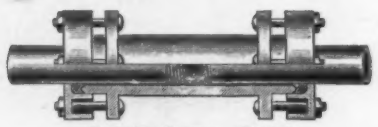


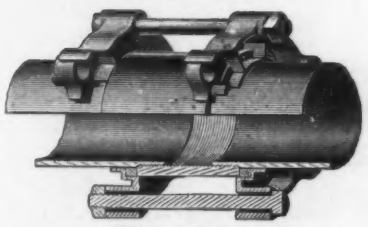
Insulating Coupling for Wrought Iron Pipe. Style 5.



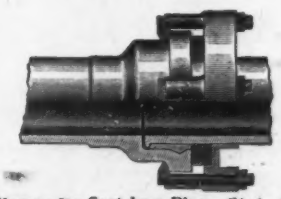
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



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My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

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Economize Heat in Water Gas Plants,

BY UTILIZING A

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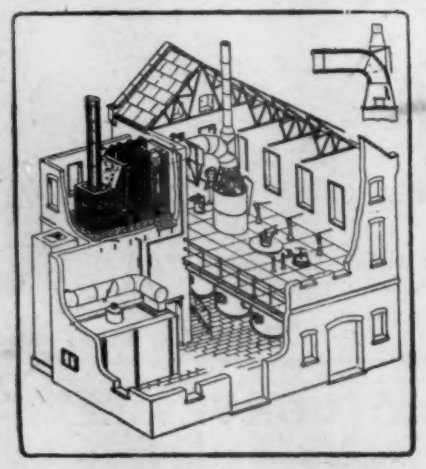

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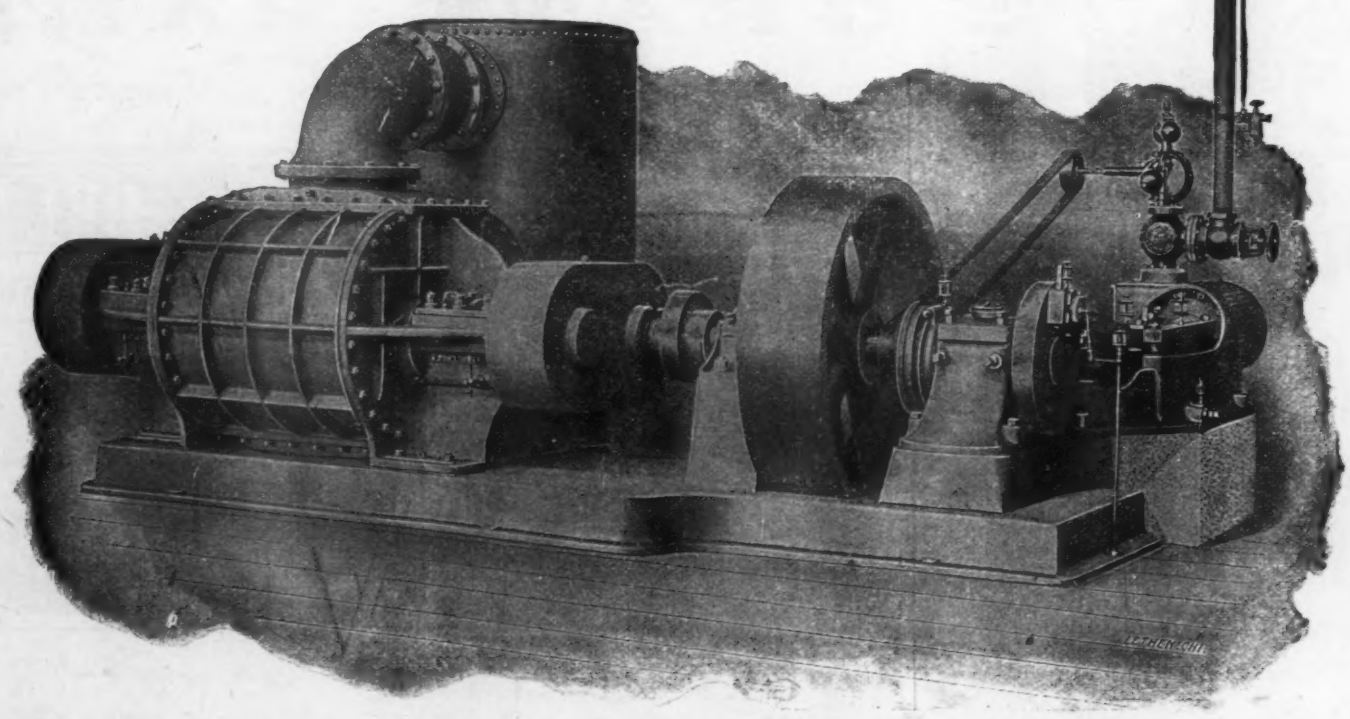

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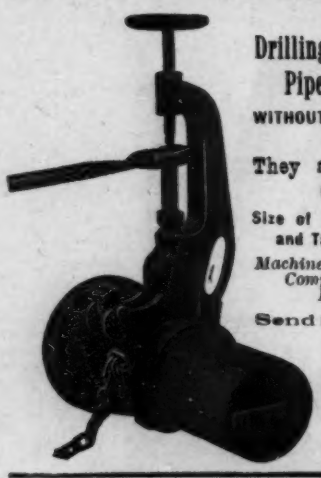

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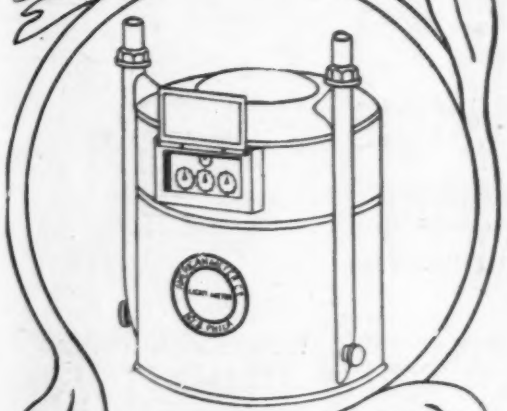
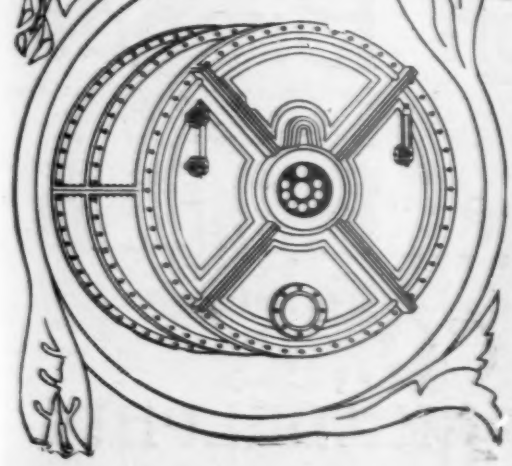
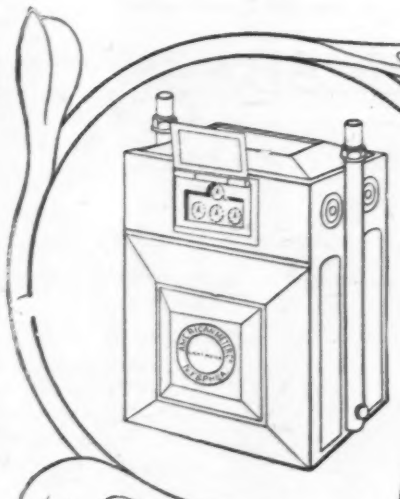


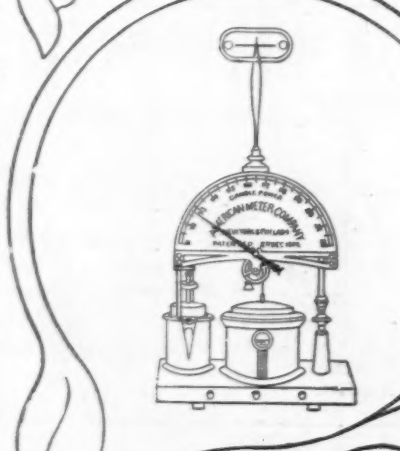


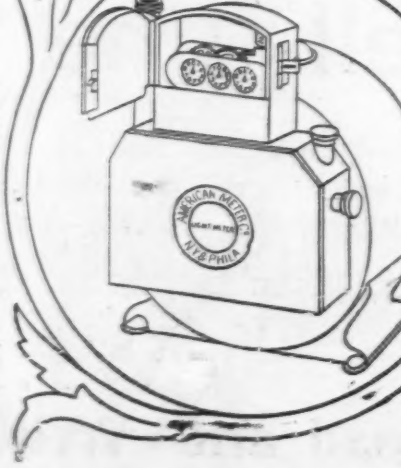
PUBLIC LIGHTING TABLE.

JUNE, 1904.

Day of Week.	Date	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Wed.	1	7.50 PM	11.10 PM	7.15	3.15
Thu.	2	7.50	11.40	7.15	3.15
Fri.	3	7.50	12.20 AM	7.15	3.15
Sat.	4	7.50	12.50	7.25	3.15
Sun.	5	8.00 LQ	1.20	7.25	3.15
Mon.	6	8.00	1.50	7.25	3.15
Tue.	7	8.00	2.20	7.25	3.15
Wed.	8	8.00	2.50	7.25	3.15
Thu.	9	8.00	3.30	7.25	3.15
Fri.	10	8.00	3.30	7.25	3.15
Sat.	11	8.00	3.30	7.25	3.15
Sun.	12	8.00	3.30	7.25	3.15
Mon.	13	8.00 NM	3.30	7.25	3.15
Tue.	14	8.00	3.30	7.25	3.15
Wed.	15	8.00	3.30	7.25	3.15
Thu.	16	8.00	3.30	7.25	3.15
Fri.	17	8.00	3.30	7.25	3.15
Sat.	18	10.10	3.30	7.30	3.15
Sun.	19	10.50	3.30	7.30	3.15
Mon.	20	11.30 FQ	3.30	7.30	3.15
Tue.	21	12.00	3.30	7.30	3.15
Wed.	22	12.40 AM	3.30	7.30	3.15
Thu.	23	1.20	3.30	7.30	3.15
Fri.	24	2.00	3.30	7.30	3.15
Sat.	25	2.40	3.30	7.30	3.15
Sun.	26	No L.	No L.	7.30	3.15
Mon.	27	No L. FM	No L.	7.30	3.15
Tue.	28	No L.	No L.	7.30	3.15
Wed.	29	8.00 PM	9.40 PM	7.30	3.15
Thu.	30	8.00	10.20	7.30	3.15







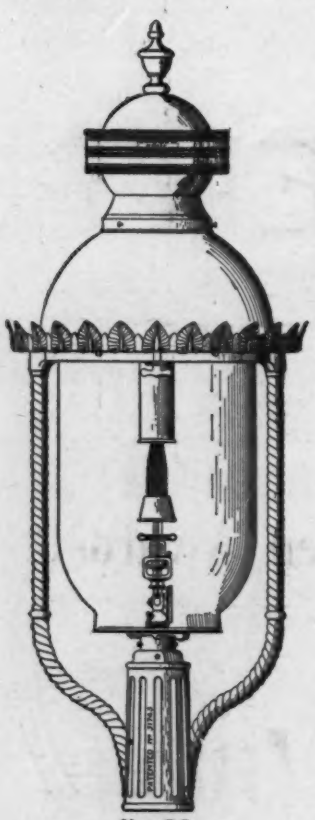
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

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By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

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THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31, 1903. has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

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Baltimore, Md.	Lynn, Mass.	New York (Central Union Co.)
Chicago, Ills.	Newark, N. J.	Cicero, Ills.
Amesbury, Mass.	Washington, D. C.	Chicago (Ogden Co.)
Aberdeen, S. D.	Boone, Ia.	Easton, Pa.
Winsted, Conn.	Pueblo, Col.	Lawrence, Mass.
Canon City, Col.	Charlotte, N. C.	Council Bluffs, Ia.
Schenectady, N. Y.	Fall River, Mass.	Chattanooga, Tenn.
Hagerstown, Md.	Duluth, Minn.	Tuckerton, N. J.
Malden, Mass.	New York (Mutual Co.)	Springfield, O.
Bridgeport, Conn.	Waltham, Mass.	Easton, Pa. (2d contract).
Albert Lea, Minn.	Dover, Del.	Mobile, Ala.
Brooklyn, N. Y.	York, Pa.	Conshohocken, Pa.
Kansas City, Kas.	Minneapolis, Minn.	Mason City, Ia.
Hempstead, N. Y.	Allentown, Pa.	

TOTAL SETS FOR 1903, ... 62
TOTAL DAILY CAPACITY, ... 62,950,000 cubic feet.
TOTAL SETS TO DATE, ... 508
TOTAL DAILY CAPACITY, ... 362,780,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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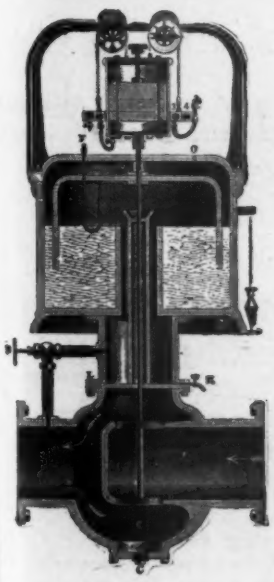

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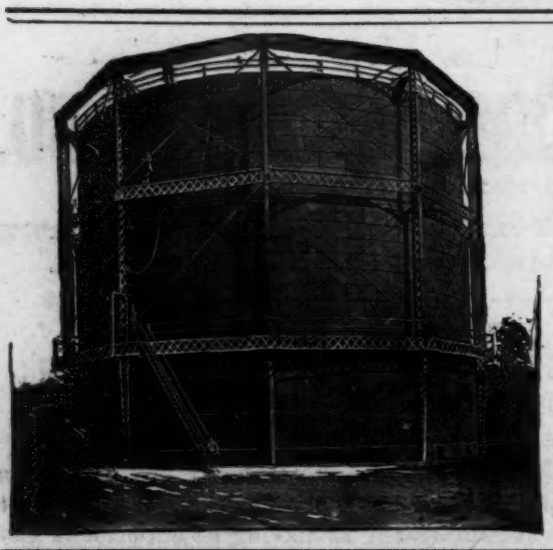

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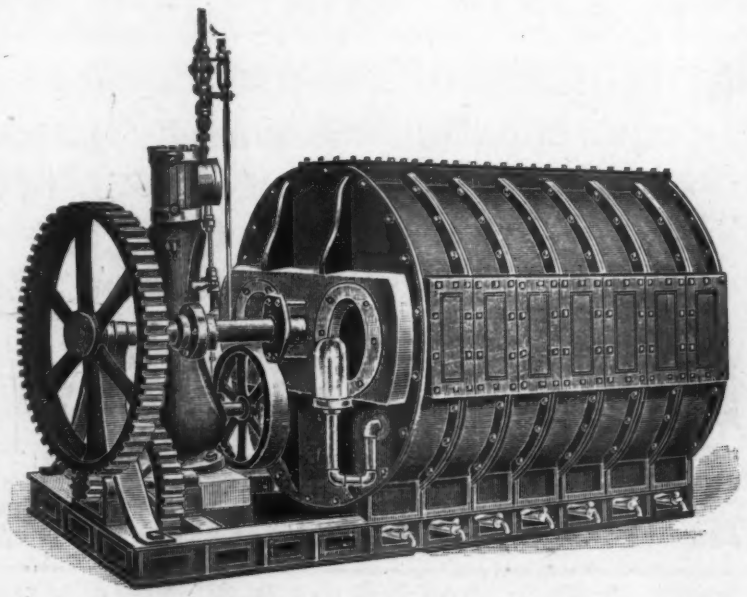

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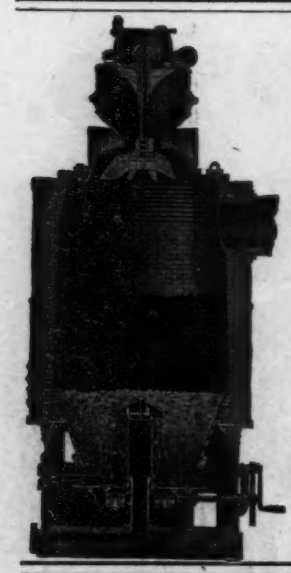

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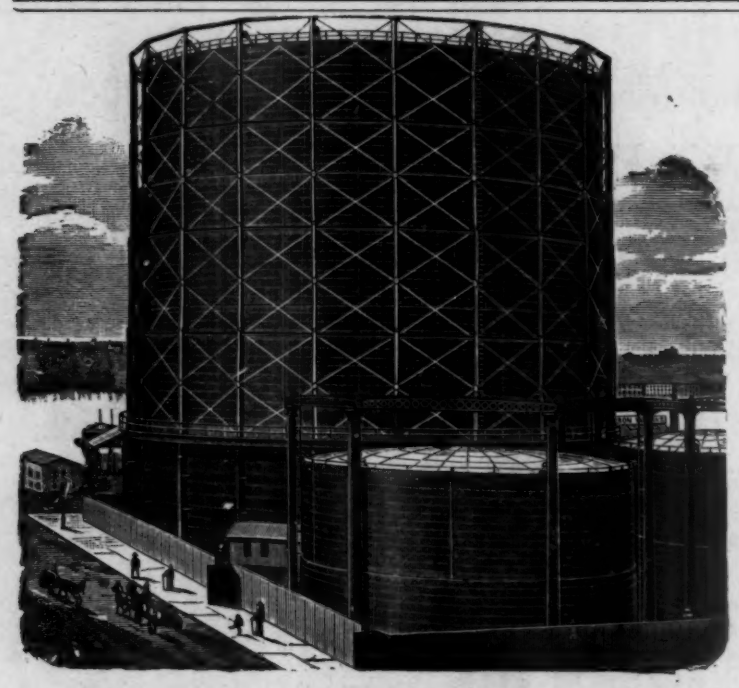

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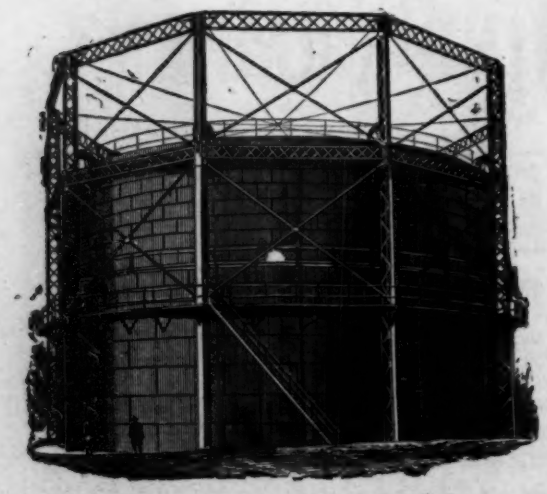

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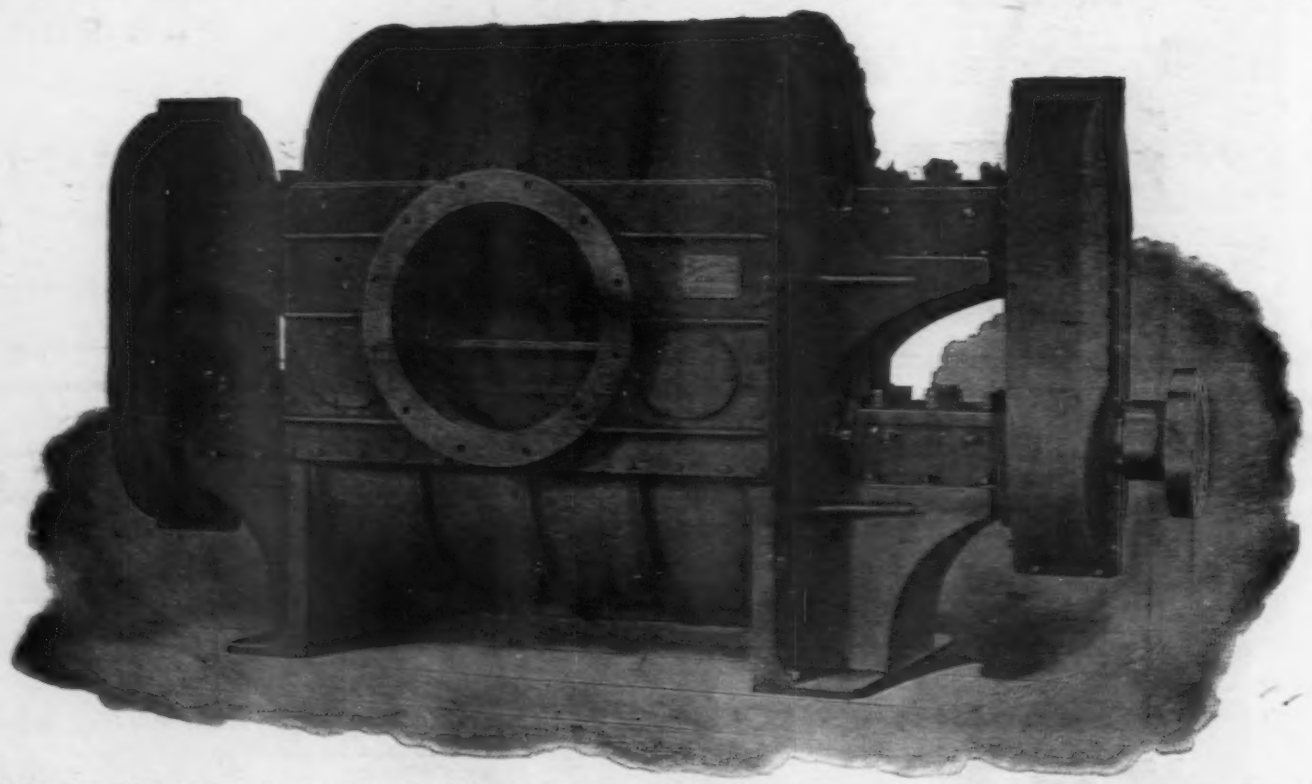

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THE PREPAYMENT SYSTEM IS PROFITABLE FOR THE GAS MAN AND PLEASANT FOR THE CONSUMER.

OVER 125,000 OF THE POSITIVE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES.

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